Administrative Package Cover Page

This file contains the following documents:

1. Summary of application (in plain language)
   - English
   - Alternative Language (Spanish)
2. First Notice (NORI-Notice of Receipt of Application and Intent to Obtain a Permit)
   - English
   - Alternative Language (Spanish)
3. Application materials

Portada de Paquete Administrativo

Este archivo contiene los siguientes documentos:

1. Resumen en lenguaje sencillo (PLS, por sus siglas en inglés) de la actividad propuesta
   - Inglés
   - Idioma alternativo (español)
2. Primer aviso (NORI, por sus siglas en inglés)
   - Inglés
   - Idioma alternativo (español)
3. Solicitud original

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

NOTICE OF RECEIPT OF APPLICATION AND INTENT TO OBTAIN WATER QUALITY PERMIT RENEWAL

PERMIT NO. WQ0001245000

APPLICATION. Luminant Generation Company LLC, 6555 Sierra Drive, Irving, Texas 75039, which owns the Lake Hubbard Steam Electric Station, has applied to the Texas Commission on Environmental Quality (TCEQ) to renew Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0001245000 (EPA I.D. No. TX0001023) to authorize the discharge of treated wastewater and stormwater at a volume not to exceed a daily average flow of 870,000,000 gallons per day. The facility is located at 555 Barnes Bridge Road, near the city of Sunnyvale, in Dallas County, Texas 75182. The discharge route is from the plant site via Outfall 001 directly to Lake Ray Hubbard. TCEQ received this application on August 23, 2024. The permit application will be available for viewing and copying at Dallas County Clerks's Office, Recording Division, 22nd Floor, 1201 Elm Street, Dallas, Texas prior to the date this notice is published in the newspaper. The application, including any updates, and associated notices are available electronically at the following webpage: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tpdes-applications . This link to an electronic map of the site or facility's general location is provided as a public courtesy and not part of the application or notice. For the exact location, refer to the application. https://gisweb.tceq.texas.gov/LocationMapper/?marker=-96.546388,32.836111&level=18

ALTERNATIVE LANGUAGE NOTICE. Alternative language notice in Spanish is available at: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tpdes-applications. El aviso de idioma alternativo en español está disponible en https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tpdes-applications.

ADDITIONAL NOTICE. TCEQ's Executive Director has determined the application is administratively complete and will conduct a technical review of the application. After technical review of the application is complete, the Executive Director may prepare a draft permit and will issue a preliminary decision on the application. **Notice of the Application and Preliminary Decision will be published and mailed to those who are on the county-wide mailing list and to those who are on the mailing list for this application. That notice will contain the deadline for submitting public comments.**

PUBLIC COMMENT / PUBLIC MEETING. You may submit public comments or request a public meeting on this application. The purpose of a public meeting is to provide the opportunity to submit comments or to ask questions about the application. TCEQ will hold a public meeting if the Executive Director determines that there is a significant degree of public

interest in the application or if requested by a local legislator. A public meeting is not a contested case hearing.

OPPORTUNITY FOR A CONTESTED CASE HEARING. After the deadline for submitting public comments, the Executive Director will consider all timely comments and prepare a response to all relevant and material, or significant public comments. **Unless the application is directly referred for a contested case hearing, the response to comments, and the Executive Director's decision on the application, will be mailed to everyone who submitted public comments and to those persons who are on the mailing list for this application. If comments are received, the mailing will also provide instructions for requesting reconsideration of the Executive Director's decision and for requesting a contested case hearing.** A contested case hearing is a legal proceeding similar to a civil trial in state district court.

TO REQUEST A CONTESTED CASE HEARING, YOU MUST INCLUDE THE FOLLOWING ITEMS IN YOUR REQUEST: your name, address, phone number; applicant's name and proposed permit number; the location and distance of your property/activities relative to the proposed facility; a specific description of how you would be adversely affected by the facility in a way not common to the general public; a list of all disputed issues of fact that you submit during the comment period and, the statement "[I/we] request a contested case hearing." If the request for contested case hearing is filed on behalf of a group or association, the request must designate the group's representative for receiving future correspondence; identify by name and physical address an individual member of the group who would be adversely affected by the proposed facility or activity; provide the information discussed above regarding the affected member's location and distance from the facility or activity; explain how and why the member would be affected; and explain how the interests the group seeks to protect are relevant to the group's purpose.

Following the close of all applicable comment and request periods, the Executive Director will forward the application and any requests for reconsideration or for a contested case hearing to the TCEQ Commissioners for their consideration at a scheduled Commission meeting.

The Commission may only grant a request for a contested case hearing on issues the requestor submitted in their timely comments that were not subsequently withdrawn. **If a hearing is granted, the subject of a hearing will be limited to disputed issues of fact or mixed questions of fact and law relating to relevant and material water quality concerns submitted during the comment period.**

TCEQ may act on an application to renew a permit for discharge of wastewater without providing an opportunity for a contested case hearing if certain criteria are met.]

MAILING LIST. If you submit public comments, a request for a contested case hearing or a reconsideration of the Executive Director's decision, you will be added to the mailing list for this specific application to receive future public notices mailed by the Office of the Chief Clerk. In addition, you may request to be placed on: (1) the permanent mailing list for a specific applicant name and permit number; and/or (2) the mailing list for a specific county. If you wish to be placed on the permanent and/or the county mailing list, clearly specify which list(s) and send your request to TCEQ Office of the Chief Clerk at the address below.

INFORMATION AVAILABLE ONLINE. For details about the status of the application, visit the Commissioners' Integrated Database at www.tceq.texas.gov/goto/cid. Search the database using the permit number for this application, which is provided at the top of this notice.

AGENCY CONTACTS AND INFORMATION. All public comments and requests must be submitted either electronically at **https://www14.tceq.texas.gov/epic/eComment/**, or in writing to the Texas Commission on Environmental Quality, Office of the Chief Clerk, MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Please be aware that any contact information you provide, including your name, phone number, email address and physical address will become part of the agency's public record. For more information about this permit application or the permitting process, please call the TCEQ Public Education Program, Toll Free, at 1-800-687-4040 or visit their website at www.tceq.texas.gov/goto/pep. Si desea información en Español, puede llamar al 1-800-687-4040.

Further information may also be obtained from Luminant Generation Company LLC at the address stated above or by calling Mr. Ryan Bayle, Environmental Manager, at 214-875-8294.

Issuance Date: October 25, 2024

Comisión de Calidad Ambiental del Estado de Texas

AVISO DE RECIBO DE LA SOLICITUD Y
EL INTENTO DE OBTENER PERMISO PARA LA CALIDAD DEL AGUA
RENOVACION

PERMISO NO. WQ0001245000

SOLICITUD. Luminant Generation Company LLC, 6555 Sierra Drive, Irving, Texas 75039, propietaria de la Central de Vapor y Electricidad de Lake Hubbard, ha solicitado a la Comisión de Calidad Ambiental de Texas (TCEQ) la renovación del Permiso N.º WQ0001245000 (N.º de identificación de la EPA TX0001023) del Sistema de Eliminación de Descargas Contaminantes de Texas (TPDES) para autorizar la descarga de aguas residuales y pluviales tratadas en un volumen que no supere un caudal medio diario de 870.000.000 de galones por día. La instalación está ubicada en 555 Barnes Bridge Road, en la ciudad de Sunnyvale, en el condado de Dallas, Texas 75182. La ruta de descarga es desde el sitio de la planta hasta el Desagüe 001 directamente al lago Ray Hubbard. La TCEQ recibió esta solicitud el 23 de agosto de 2024. La solicitud de permiso estará disponible para su consulta y copia en la Oficina del Secretario del Condado de Dallas, División de Registros, Piso 22, 1201 Elm Street, Dallas, Texas, antes de la fecha en que se publique este aviso en el periódico. La solicitud, incluidas las actualizaciones y los avisos asociados, están disponibles electrónicamente en la siguiente página web: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tpdes-applications. Este enlace a un mapa electrónico de la ubicación general del sitio o instalación se proporciona como cortesía pública y no forma parte de la solicitud o el aviso. Para conocer la ubicación exacta, consulte la solicitud. https://gisweb.tceq.texas.gov/LocationMapper/?marker=-96.546388,32.836111&level=18

AVISO ADICIONAL. El Director Ejecutivo de la TCEQ ha determinado que la solicitud es administrativamente completa y conducirá una revisión técnica de la solicitud. Después de completar la revisión técnica, el Director Ejecutivo puede preparar un borrador del permiso y emitirá una Decisión Preliminar sobre la solicitud. **El aviso de la solicitud y la decisión preliminar serán publicados y enviado a los que están en la lista de correo de las personas a lo largo del condado que desean**

recibir los avisos y los que están en la lista de correo que desean recibir avisos de esta solicitud. El aviso dará la fecha límite para someter comentarios públicos.

COMENTARIO PUBLICO / REUNION PUBLICA. Usted puede presentar comentarios públicos o pedir una reunión pública sobre esta solicitud. El propósito de una reunión pública es dar la oportunidad de presentar comentarios o hacer preguntas acerca de la solicitud. La TCEQ realiza una reunión pública si el Director Ejecutivo determina que hay un grado de interés público suficiente en la solicitud o si un legislador local lo pide. Una reunión pública no es una audiencia administrativa de lo contencioso.

OPORTUNIDAD DE UNA AUDIENCIA ADMINISTRATIVA DE LO CONTENCIOSO. Después del plazo para presentar comentarios públicos, el Director Ejecutivo considerará todos los comentarios apropiados y preparará una respuesta a todo los comentarios públicos esenciales, pertinentes, o significativos. **A menos que la solicitud haya sido referida directamente a una audiencia administrativa de lo contencioso, la respuesta a los comentarios y la decisión del Director Ejecutivo sobre la solicitud serán enviados por correo a todos los que presentaron un comentario público y a las personas que están en la lista para recibir avisos sobre esta solicitud. Si se reciben comentarios, el aviso también proveerá instrucciones para pedir una reconsideración de la decisión del Director Ejecutivo y para pedir una audiencia administrativa de lo contencioso.** Una audiencia administrativa de lo contencioso es un procedimiento legal similar a un procedimiento legal civil en un tribunal de distrito del estado.

PARA SOLICITAR UNA AUDIENCIA DE CASO IMPUGNADO, USTED DEBE INCLUIR EN SU SOLICITUD LOS SIGUIENTES DATOS: su nombre, dirección, y número de teléfono; el nombre del solicitante y número del permiso; la ubicación y distancia de su propiedad/actividad con respecto a la instalación; una descripción específica de la forma cómo usted sería afectado adversamente por el sitio de una manera no común al público en general; una lista de todas las cuestiones de hecho en disputa que usted presente durante el período de comentarios; y la declaración "[Yo/nosotros] solicito/solicitamos una audiencia de caso impugnado". Si presenta la petición para una audiencia de caso impugnado de parte de un grupo o asociación, debe identificar una persona que representa al grupo para recibir correspondencia en el futuro; identificar el nombre y la dirección de un miembro del grupo que sería afectado adversamente por la planta o la actividad propuesta; proveer la información indicada anteriormente con respecto a la ubicación del miembro afectado y su distancia de la planta o actividad propuesta; explicar cómo y porqué el miembro sería afectado; y explicar cómo los intereses que el grupo desea proteger son pertinentes al propósito del grupo.

Después del cierre de todos los períodos de comentarios y de petición que aplican, el Director Ejecutivo enviará la solicitud y cualquier petición para reconsideración o para una audiencia de caso impugnado a los Comisionados de la TCEQ para su consideración durante una reunión programada de la Comisión. La Comisión sólo puede conceder una solicitud de una audiencia de caso impugnado sobre los temas que el solicitante haya presentado en sus comentarios oportunos que no fueron retirados posteriormente. Si se concede una audiencia, el tema de la audiencia estará limitado a cuestiones de hecho en disputa o cuestiones mixtas de hecho y de derecho relacionadas a intereses pertinentes y materiales de calidad del agua que se hayan presentado durante el período de comentarios.

Si ciertos criterios se cumplen, la TCEQ puede actuar sobre una solicitud para renovar un permiso sin proveer una oportunidad de una audiencia administrativa de lo contencioso.

LISTA DE CORREO. Si somete comentarios públicos, un pedido para una audiencia administrativa de lo contencioso o una reconsideración de la decisión del Director Ejecutivo, la Oficina del Secretario Principal enviará por correo los avisos públicos en relación con la solicitud. Ademas, puede pedir que la TCEQ ponga su nombre en una or mas de las listas correos siguientes (1) la lista de correo permanente para recibir los avisos de el solicitante indicado por nombre y número del permiso específico y/o (2) la lista de correo de todas las solicitudes en un condado especifico. Si desea que se agrega su nombre en una de las listas designe cual lista(s) y envia por correo su pedido a la Oficina del Secretario Principal de la TCEQ.

CONTACTOS E INFORMACIÓN A LA AGENCIA. Todos los comentarios públicos y solicitudes deben ser presentadas electrónicamente vía http://www14.tceq.texas.gov/epic/eComment/ o por escrito dirigidos a la Comisión de Texas de Calidad Ambiental, Oficial de la Secretaría (Office of Chief Clerk), MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Tenga en cuenta que cualquier información personal que usted proporcione, incluyendo su nombre, número de teléfono, dirección de correo electrónico y dirección física pasarán a formar parte del registro público de la Agencia. Para obtener más información acerca de esta solicitud de permiso o el proceso de permisos, llame al programa de educación pública de la TCEQ, gratis, al 1-800-687-4040. Si desea información en Español, puede llamar al 1-800-687-4040.

También se puede obtener más información de Luminant Generation Company LLC en la dirección indicada anteriormente o llamando al Sr. Ryan Bayle, Gerente Ambiental, al 214-875-8294.

Fecha de emission 25 de octubre de 2024

Lake Hubbard Steam Electric Station
WQ0001245000
PLAIN LANGUAGE SUMMARY

The following summary is provided for this pending water quality permit application being reviewed by the Texas Commission on Environmental Quality as required by 30 Texas Administrative Code Chapter 39. The information provided in this summary may change during the technical review of the application and are not federal enforceable representations of the permit application.

Luminant Generation Company LLC (CN603256413) operates the Lake Hubbard Steam Electric Station (RN100673490), located at 555 Barnes Bridge Road, Sunnyvale, Dallas County, Texas 75182. The facility currently consists of two natural gas-fired steam electric generating units.

This application is for the renewal of Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0001245000 (EPA I.D. No. TX001023) which authorizes the discharge of wastewaters (once-through cooling and auxiliary cooling water) and previously monitored effluent (floor/equipment drains, equipment blowdown, water treatment wastes, low volume waste, metal cleaning waste and storm water) at a daily average flow not to exceed 870 million gallons per day via Outfall 001.

The discharge of once-through cooling water via Outfall 001 and previously monitored effluent via Outfall 101 from this facility is subject to federal effluent limitation guidelines at 40 CFR Part 423. The pollutants expected from these discharges based on 40 CFR Part 423 are: total residual chlorine, free available chlorine, total suspended solids, oil and grease, total iron, total copper and pH. Temperature is also expected from discharges of 001.

The raw water supply for the facility's cooling water and service water systems is from Lake Ray Hubbard Reservoir, supplied by the City of Dallas. A chemical feed system supplies water conditioning chemicals to the once-through cooling water to minimize corrosion and control the formation of mineral scale and bio-fouling. Domestic wastes are routed to the Duck Creek Wastewater Treatment Plant.

Estación eléctrica de vapor del lago Hubbard
WQ0001245000
RESUMEN EN LENGUAJE SENCILLO

El siguiente resumen se proporciona para esta solicitud de permiso de calidad del agua pendiente que está siendo revisada por la Comisión de Calidad Ambiental de Texas según lo exige el Capítulo 39 del Código Administrativo de Texas 30. La información proporcionada en este resumen puede cambiar durante la revisión técnica de la solicitud y no es federal. representaciones ejecutables de la solicitud de permiso.

Luminant Generation Company LLC (CN603256413) opera la estación eléctrica de vapor Lake Hubbard (RN100673490), ubicada en 555 Barnes Bridge Road, Sunnyvale, condado de Dallas, Texas 75182. La instalación actualmente consta de dos unidades generadoras de electricidad a vapor alimentadas con gas natural.

Esta solicitud es para la renovación del permiso No. WQ0001245000 del Sistema de Eliminación de Descarga de Contaminantes de Texas (TPDES) (EPA I.D. No. TX001023) que autoriza la descarga de aguas residuales (agua de enfriamiento de un solo paso y agua de enfriamiento auxiliar) y efluentes previamente monitoreados (piso/equipo). drenajes, purga de equipos, desechos de tratamiento de agua, desechos de bajo volumen, desechos de limpieza de metales y aguas pluviales) a un flujo promedio diario que no exceda los 870 millones de galones por día a través del Emisario 001.

La descarga de agua de enfriamiento de un solo paso a través del Emisario 001 y el efluente previamente monitoreado a través del Emisario 101 de esta instalación está sujeta a pautas federales de limitación de efluentes en 40 CFR Parte 423. Los contaminantes esperados de estas descargas con base en 40 CFR Parte 423 son: total residual cloro, cloro libre disponible, sólidos suspendidos totales, aceites y grasas, hierro total, cobre total y pH. También se espera temperatura por descargas de 001.

El suministro de agua cruda para los sistemas de agua de refrigeración y agua de servicio de la instalación proviene del embalse Lake Ray Hubbard, suministrado por la ciudad de Dallas. Un sistema de alimentación de químicos suministra químicos acondicionadores de agua al agua de enfriamiento de un solo paso para minimizar la corrosión y controlar la formación de incrustaciones minerales y bioincrustaciones. Los desechos domésticos se envían a la planta de tratamiento de aguas residuales de Duck Creek.

Abesha Michael

From: Bayle, Ryan <Ryan.Bayle@luminant.com>
Sent: Monday, October 21, 2024 8:47 AM
To: Abesha Michael
Subject: RE: Application to Renew Permit No. WQ0001245000 - Notice of Deficiency Letter
Attachments: WQ0001245000_NORI Spanish.docx

Good morning Abesha,

I received your voicemail from last week. I apologize for this falling through the cracks.

I only have one comment on the NORI. The street address for the facility contains a typo. The corrected spelling is as follows.

"The facility is located at 555 ~~Bames~~ Barnes Bridge Road, in the city of Sunnyvale, in Dallas County, Texas 75182."

As requested, a Word document of the translated NORI is attached. Please note that the correction noted above has been made.

Thank you,

Ryan Bayle, P.G.
Environmental Manager
Ryan.Bayle@vistracorp.com
Vistra

6555 Sierra Drive | Irving, Texas, 75039
M 214.212.2777

From: Abesha Michael <Abesha.Michael@tceq.texas.gov>
Sent: Friday, August 30, 2024 1:06 PM
To: Bayle, Ryan <Ryan.Bayle@luminant.com>
Cc: Manthei, Dustin <Dustin.Manthei@luminant.com>
Subject: Application to Renew Permit No. WQ0001245000 - Notice of Deficiency Letter

Dear Mr. Bayle:

The attached Notice of Deficiency letter sent on August 30, 2024, requests additional information needed to declare the application administratively complete. Please send the complete response to my attention by September 13, 2024.

Thank you,

message or its attachments is strictly prohibited. If you have received this message in error, please notify the sender immediately by reply message and delete this email message and any attachments from your system.

Comisión de Calidad Ambiental del Estado de Texas

AVISO DE RECIBO DE LA SOLICITUD Y
EL INTENTO DE OBTENER PERMISO PARA LA CALIDAD DEL AGUA
RENOVACION

PERMISO NO. WQ000

SOLICITUD. Luminant Generation Company LLC, 6555 Sierra Drive, Irving, Texas 75039, propietaria de la Central de Vapor y Electricidad de Lake Hubbard, ha solicitado a la Comisión de Calidad Ambiental de Texas (TCEQ) la renovación del Permiso N.º WQ0001245000 (N.º de identificación de la EPA TX0001023) del Sistema de Eliminación de Descargas Contaminantes de Texas (TPDES) para autorizar la descarga de aguas residuales y pluviales tratadas en un volumen que no supere un caudal medio diario de 870.000.000 de galones por día. La instalación está ubicada en 555 Barnes Bridge Road, en la ciudad de Sunnyvale, en el condado de Dallas, Texas 75182. La ruta de descarga es desde el sitio de la planta hasta el Desagüe 001 directamente al lago Ray Hubbard. La TCEQ recibió esta solicitud el 23 de agosto de 2024. La solicitud de permiso estará disponible para su consulta y copia en la Oficina del Secretario del Condado de Dallas, División de Registros, Piso 22, 120 Elm Street, Dallas, en el Condado de Dallas, Texas, antes de la fecha en que se publique este aviso en el periódico. La solicitud, incluidas las actualizaciones y los avisos asociados, están disponibles electrónicamente en la siguiente página web: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tpdes-applications. Este enlace a un mapa electrónico de la ubicación general del sitio o instalación se proporciona como cortesía pública y no forma parte de la solicitud o el aviso. Para conocer la ubicación exacta, consulte la solicitud. https://gisweb.tceq.texas.gov/LocationMapper/?marker=-96.546388,32.836111&level=18

AVISO ADICIONAL. El Director Ejecutivo de la TCEQ ha determinado que la solicitud es administrativamente completa y conducirá una revisión técnica de la solicitud. Después de completar la revisión técnica, el Director Ejecutivo puede preparar un borrador del permiso y emitirá una Decisión Preliminar sobre la solicitud. **El aviso de la solicitud y la decisión preliminar serán publicados y enviado a los que están en la lista de correo de las personas a lo largo del condado que desean**

recibir los avisos y los que están en la lista de correo que desean recibir avisos de esta solicitud. El aviso dará la fecha límite para someter comentarios públicos.

COMENTARIO PUBLICO / REUNION PUBLICA. Usted puede presentar comentarios públicos o pedir una reunión pública sobre esta solicitud. El propósito de una reunión pública es dar la oportunidad de presentar comentarios o hacer preguntas acerca de la solicitud. La TCEQ realiza una reunión pública si el Director Ejecutivo determina que hay un grado de interés público suficiente en la solicitud o si un legislador local lo pide. Una reunión pública no es una audiencia administrativa de lo contencioso.

OPORTUNIDAD DE UNA AUDIENCIA ADMINISTRATIVA DE LO CONTENCIOSO. Después del plazo para presentar comentarios públicos, el Director Ejecutivo considerará todos los comentarios apropiados y preparará una respuesta a todo los comentarios públicos esenciales, pertinentes, o significativos. **A menos que la solicitud haya sido referida directamente a una audiencia administrativa de lo contencioso, la respuesta a los comentarios y la decisión del Director Ejecutivo sobre la solicitud serán enviados por correo a todos los que presentaron un comentario público y a las personas que están en la lista para recibir avisos sobre esta solicitud. Si se reciben comentarios, el aviso también proveerá instrucciones para pedir una reconsideración de la decisión del Director Ejecutivo y para pedir una audiencia administrativa de lo contencioso.** Una audiencia administrativa de lo contencioso es un procedimiento legal similar a un procedimiento legal civil en un tribunal de distrito del estado.

PARA SOLICITAR UNA AUDIENCIA DE CASO IMPUGNADO, USTED DEBE INCLUIR EN SU SOLICITUD LOS SIGUIENTES DATOS: su nombre, dirección, y número de teléfono; el nombre del solicitante y número del permiso; la ubicación y distancia de su propiedad/actividad con respecto a la instalación; una descripción específica de la forma cómo usted sería afectado adversamente por el sitio de una manera no común al público en general; una lista de todas las cuestiones de hecho en disputa que usted presente durante el período de comentarios; y la declaración "[Yo/nosotros] solicito/solicitamos una audiencia de caso impugnado". Si presenta la petición para una audiencia de caso impugnado de parte de un grupo o asociación, debe identificar una persona que representa al grupo para recibir correspondencia en el futuro; identificar el nombre y la dirección de un miembro del grupo que sería afectado adversamente por la planta o la actividad propuesta; proveer la información indicada anteriormente con respecto a la ubicación del miembro afectado y su distancia de la planta o actividad propuesta; explicar cómo y porqué el miembro sería afectado; y explicar cómo los intereses que el grupo desea proteger son pertinentes al propósito del grupo.

Después del cierre de todos los períodos de comentarios y de petición que aplican, el Director Ejecutivo enviará la solicitud y cualquier petición para reconsideración o para una audiencia de caso impugnado a los Comisionados de la TCEQ para su consideración durante una reunión programada de la Comisión. La Comisión sólo puede conceder una solicitud de una audiencia de caso impugnado sobre los temas que el solicitante haya presentado en sus comentarios oportunos que no fueron retirados posteriormente. Si se concede una audiencia, el tema de la audiencia estará limitado a cuestiones de hecho en disputa o cuestiones mixtas de hecho y de derecho relacionadas a intereses pertinentes y materiales de calidad del agua que se hayan presentado durante el período de comentarios. . *[For renewal applications that **do not** include a major amendment, include the following sentence:]* **Si ciertos criterios se cumplen, la TCEQ puede actuar sobre una solicitud para renovar un permiso sin proveer una oportunidad de una audiencia administrativa de lo contencioso.**

LISTA DE CORREO. Si somete comentarios públicos, un pedido para una audiencia administrativa de lo contencioso o una reconsideración de la decisión del Director Ejecutivo, la Oficina del Secretario Principal enviará por correo los avisos públicos en relación con la solicitud. Ademas, puede pedir que la TCEQ ponga su nombre en una or mas de las listas correos siguientes (1) la lista de correo permanente para recibir los avisos de el solicitante indicado por nombre y número del permiso específico y/o (2) la lista de correo de todas las solicitudes en un condado especifico. Si desea que se agrega su nombre en una de las listas designe cual lista(s) y envia por correo su pedido a la Oficina del Secretario Principal de la TCEQ.

CONTACTOS E INFORMACIÓN A LA AGENCIA. Todos los comentarios públicos y solicitudes deben ser presentadas electrónicamente vía http://www14.tceq.texas.gov/epic/eComment/ o por escrito dirigidos a la Comisión de Texas de Calidad Ambiental, Oficial de la Secretaría (Office of Chief Clerk), MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Tenga en cuenta que cualquier información personal que usted proporcione, incluyendo su nombre, número de teléfono, dirección de correo electrónico y dirección física pasarán a formar parte del registro público de la Agencia. Para obtener más información acerca de esta solicitud de permiso o el proceso de permisos, llame al programa de educación pública de la TCEQ, gratis, al 1-800-687-4040. Si desea información en Español, puede llamar al 1-800-687-4040.

También se puede obtener más información de Luminant Generation Company LLC en la dirección indicada anteriormente o llamando al Sr. Ryan Bayle, Gerente Ambiental, Luminant Generation Company LLC, al 214-875-8294.

Fecha de emission _____ *[Date notice issued]*

Luminant

Renee Collins
Sr. Director,
Environmental Services
renee.collins@luminant.com

Luminant
6555 Sierra Drive
Irving, TX 75039

T 214.875.8338
C 214.406.2452
F 214.875.8699

Delivered Via FedEx
FTP File Upload

August 22, 2024

Texas Commission on Environmental Quality
Water Quality Division
Applications Review and Processing Team (MC148)
12100 Park 35 Circle
Austin, Texas 78753

Re: Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Industrial Wastewater Permit Renewal Application
TPDES Permit No. WQ0001245000

Dear Sir/Madam:

Luminant Generation Company LLC hereby submits one original and two copies of the Industrial Wastewater Permit Application for renewal of the above referenced TPDES Permit. This application consists of the "Industrial Administrative Report" and the "Industrial Technical Report" and associated attachments. A copy of the complete application will also be uploaded to the TCEQ FTP server.

If you have any questions, please contact Ryan Bayle at 214-875-8294 or via e-mail at ryan.bayle@luminant.com.

Sincerely,

Renee Collins

RMB
Attachment

Luminant

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station

TPDES Industrial Wastewater Permit Renewal Application

Permit No. WQ0001245000

August 2024

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

INDUSTRIAL WASTEWATER PERMIT APPLICATION CHECKLIST

Complete and submit this checklist with the industrial wastewater permit application.

APPLICANT NAME: Luminant Generation Company LLC

PERMIT NUMBER (If new, leave blank): WQ00 01245000

Indicate if each of the following items is included in your application.

	Y	N		Y	N
Administrative Report 1.0	☒	☐	Worksheet 8.0	☐	☒
Administrative Report 1.1	☐	☒	Worksheet 9.0	☐	☒
SPIF	☒	☐	Worksheet 10.0	☐	☒
Core Data Form	☒	☐	Worksheet 11.0	☒	☐
Public Involvement Plan Form	☐	☒	Worksheet 11.1	☒	☐
Plain Language Summary	☒	☐	Worksheet 11.2	☒	☐
Technical Report 1.0	☒	☐	Worksheet 11.3	☒	☐
Worksheet 1.0	☒	☐	Original USGS Map	☒	☐
Worksheet 2.0	☒	☐	Affected Landowners Map	☐	☒
Worksheet 3.0	☐	☒	Landowner Disk or Labels	☐	☒
Worksheet 3.1	☐	☒	Flow Diagram	☒	☐
Worksheet 3.2	☐	☒	Site Drawing	☒	☐
Worksheet 3.3	☐	☒	Original Photographs	☐	☒
Worksheet 4.0	☒	☐	Design Calculations	☒	☐
Worksheet 4.1	☐	☒	Solids Management Plan	☐	☒
Worksheet 5.0	☐	☒	Water Balance	☒	☐
Worksheet 6.0	☐	☒			
Worksheet 7.0	☐	☒			

For TCEQ Use Only

Segment Number _____ County _____

Expiration Date _____ Region _____

Permit Number _____

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

INDUSTRIAL WASTEWATER PERMIT APPLICATION ADMINISTRATIVE REPORT 1.0

This report is required for all applications for TPDES permits and TLAPs, except applications for oil and gas extraction operations subject to 40 CFR Part 435. Contact the Applications Review and Processing Team at 512-239-4671 with any questions about completing this report.

Applications for oil and gas extraction operations subject to 40 CFR Part 435 must use the Oil and Gas Exploration and Production Administrative Report (TCEQ Form-20893 and 20893-inst[1]).

Item 1. Application Information and Fees (Instructions, Page 26)

a. Complete each field with the requested information, if applicable.

Applicant Name: Luminant Generation Company LLC

Permit No.: WQ0001245000

EPA ID No.: TX0001023

Expiration Date: Click to enter text.

b. Check the box next to the appropriate authorization type.

☒ Industrial Wastewater (wastewater and stormwater)

☐ Industrial Stormwater (stormwater only)

c. Check the box next to the appropriate facility status.

☒ Active ☐ Inactive

d. Check the box next to the appropriate permit type.

☒ TPDES Permit ☐ TLAP ☐ TPDES with TLAP component

e. Check the box next to the appropriate application type.

☐ New

☐ Renewal with changes ☒ Renewal without changes

☐ Major amendment with renewal ☐ Major amendment without renewal

☐ Minor amendment without renewal

☐ Minor modification without renewal

f. If applying for an amendment or modification, describe the request: Click to enter text.

For TCEQ Use Only

Segment Number _____ County _____

Expiration Date _____ Region _____

Permit Number _____

[1] https://www.tceq.texas.gov/publications/search_forms.html

g. Application Fee

EPA Classification	New	Major Amend. (with or without renewal)	Renewal (with or without changes)	Minor Amend. / Minor Mod. (without renewal)
Minor facility not subject to EPA categorical effluent guidelines (40 CFR Parts 400-471)	☒ $350	☒ $350	☒ $315	☒ $150
Minor facility subject to EPA categorical effluent guidelines (40 CFR Parts 400-471)	☒ $1,250	☒ $1,250	☒ $1,215	☒ $150
Major facility	N/A [2]	☒ $2,050	☒ $2,015	☒ $450

h. Payment Information

Mailed

Check or money order No.: Click to enter text.

Check or money order amt.: Click to enter text.

Named printed on check or money order: Click to enter text.

Epay

Voucher number: 718057/718058

Copy of voucher attachment: A

Item 2: Applicant Information (Instructions, Pages 26)

a. Customer Number, if applicant is an existing customer: CN603256413

Note: Locate the customer number using the TCEQ's Central Registry Customer Search[3].

b. Legal name of the entity (applicant) applying for this permit: Luminant Generation Company LLC

Note: The owner of the facility must apply for the permit. The legal name must be spelled exactly as filed with the TX SOS, Texas Comptroller of Public Accounts, County, or in the legal documents forming the entity.

c. Name and title of the person signing the application. (**Note:** The person must be an executive official that meets signatory requirements in 30 TAC § 305.44.)

Prefix: Click to enter text. Full Name (Last/First Name): Renee Collins

Title: Sr. Director Environmental Services Credential: Click to enter text.

d. Will the applicant have overall financial responsibility for the facility?

[2] All facilities are designated as minors until formally classified as a major by EPA.

[3] https://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=cust.CustSearch

☒ Yes ☐ No

Note: The entity with overall financial responsibility for the facility must apply as a co-applicant, if not the facility owner.

Item 3. Co-applicant Information (Instructions, Page 27)

☒ Check this box if there is no co-applicant.; otherwise, complete the below questions.

a. Legal name of the entity (co-applicant) applying for this permit: Click to enter text.

Note: The legal name must be spelled exactly as filed with the TX SOS, Texas Comptroller of Public Accounts, County, or in the legal documents forming the entity.

b. Customer Number (if applicant is an existing customer): CNClick to enter text.

Note: Locate the customer number using the TCEQ's Central Registry Customer Search.

c. Name and title of the person signing the application. (**Note:** The person must be an executive official that meets signatory requirements in 30 TAC § 305.44.)

Prefix: Click to enter text. Full Name (Last/First Name): Click to enter text.

Title: Click to enter text. Credential: Click to enter text.

d. Will the co-applicant have overall financial responsibility for the facility?

☒ Yes ☐ No

Note: The entity with overall financial responsibility for the facility must apply as a co-applicant, if not the facility owner.

Item 4. Core Data Form (Instructions, Pages 27)

a. Complete one Core Data Form (TCEQ Form 10400) for each customer (applicant and co-applicant(s)) and include as an attachment. If the customer type selected on the Core Data Form is Individual, complete Attachment 1 of the Administrative Report. Attachment: B

Item 5. Application Contact Information (Instructions, Page 27)

Provide names of two individuals who can be contact for additional information about this application. Indicate if the individual can be contact about administrative or technical information, or both.

a. ☒ Administrative Contact ☒ Technical Contact

Prefix: Click to enter text. Full Name (Last/First Name): Bayle, Ryan

Title: Environmental Manager Credential: P.G

Organization Name: Luminant Generation Company LLC

Mailing Address: 6555 Sierra Drive City/State/Zip: Irving/TX/75039

Phone No: 214-875-8294 Email: ryan.bayle@luminant.com

b. ☒ Administrative Contact ☒ Technical Contact

Prefix: Click to enter text. Full Name (Last/First Name): Dustin Manthei

Title: Environmental Coordinator Credential: Click to enter text.

Organization Name: Luminant Generation Company LLC

Mailing Address: 6555 Sierra Drive City/State/Zip: Irving, TX 75039

Phone No: 214-295-7334 Email: dustin.manthei@luminant.com

Attachment: N/A

Item 6. Permit Contact Information (Instructions, Page 28)

Provide two names of individuals that can be contacted throughout the permit term.

a. Prefix: Click to enter text. Full Name (Last/First Name): Bayle, Ryan

Title: Environmental Manager Credential: P.G

Organization Name: Luminant Generation Company LLC

Mailing Address: 6555 Sierra Drive City/State/Zip: Irving, TX, 75039

Phone No: 214-875-8294 Email: ryan.bayle@luminant.com

b. Prefix: Click to enter text. Full Name (Last/First Name): Click to enter text.

Title: Click to enter text. Credential: Click to enter text.

Organization Name: Click to enter text.

Mailing Address: Click to enter text. City/State/Zip: Click to enter text.

Phone No: Click to enter text. Email: Click to enter text.

Attachment: N/A

Item 7. Billing Contact Information (Instructions, Page 28)

The permittee is responsible for paying the annual fee. The annual fee will be assessed for permits **in effect on September 1 of each year**. The TCEQ will send a bill to the address provided in this section. The permittee is responsible for terminating the permit when it is no longer needed (form TCEQ-20029).

Provide the complete mailing address where the annual fee invoice should be mailed and the name and phone number of the permittee's representative responsible for payment of the invoice.

Prefix: Click to enter text. Full Name (Last/First Name): Bayle, Ryan

Title: Environmental Manager Credential: P.G

Organization Name: Luminant Generation Company LLC

Mailing Address: 6555 Sierra Drive City/State/Zip: Irving, TX. 75039

Phone No: 214-875-8294 Email: ryan.bayle@luminant.com

Item 8. DMR/MER Contact Information (Instructions, Page 28)

Provide the name and mailing address of the person delegated to receive and submit DMRs or MERs. **Note:** DMR data must be submitted through the NetDMR system. An electronic reporting account can be established once the facility has obtained the permit number.

Prefix: Click to enter text. Full Name (Last/First Name): Whitaker, Josh

Title: Environmental Reporting Manager Credential: Click to enter text.

Organization Name: Luminant Generation Company LLC

Mailing Address: 6555 Sierra Drive City/State/Zip: Irving, TX, 75039

Phone No: 214-875-8378 Email: josh.whitaker@luminant.com

Item 9. Notice Information (Instructions, Pages 28)

a. Individual Publishing the Notices

Prefix: Click to enter text. Full Name (Last/First Name): Bayle, Ryan

Title: Environmental Manager Credential: P.G

Organization Name: Luminant Generation Company LLC

Mailing Address: 6555 Sierra Drive City/State/Zip: Irving, TX, 75039

Phone No: 214-875-8294 Email: ryan.bayle@luminant.com

b. Method for Receiving Notice of Receipt and Intent to Obtain a Water Quality Permit Package (only for NORI, NAPD will be sent via regular mail)

☒ E-mail: ryan.bayle@luminant.com

☐ Fax: Click to enter text.

☒ Regular Mail (USPS)

Mailing Address: 6555 Sierra Drive

City/State/Zip Code: Irving, TX, 75039

c. Contact in the Notice

Prefix: Click to enter text. Full Name (Last/First Name): Bayle, Ryan

Title: Environmental Manager Credential: P.G

Organization Name: Luminant Generation Company LLC

Phone No: 214-875-8294 Email: ryan.bayle@luminant.com

d. Public Viewing Location Information

Note: If the facility or outfall is located in more than one county, provide a public viewing place for each county.

Public building name: Dallas County Clerk's Office Recording Division, 22nd Floor Location within the building:

Physical Address of Building: 1201 Elm Street

City: Dallas County: Dallas

e. Bilingual Notice Requirements

This information is required for new, major amendment, minor amendment or minor modification, and renewal applications.

This section of the application is only used to determine if alternative language notices will be needed. Complete instructions on publishing the alternative language notices will be in your public notice package.

Call the bilingual/ESL coordinator at the nearest elementary and middle schools and obtain the following information to determine if an alternative language notice(s) is required.

1. Is a bilingual education program required by the Texas Education Code at the elementary or middle school nearest to the facility or proposed facility?

☒ Yes ☐ No

If no, publication of an alternative language notice is not required; skip to Item 8 (Regulated Entity and Permitted Site Information.)

2. Are the students who attend either the elementary school or the middle school enrolled in a bilingual education program at that school?

   ☒ Yes ☐ No

3. Do the students at these schools attend a bilingual education program at another location?

   ☐ Yes ☒ No

4. Would the school be required to provide a bilingual education program, but the school has waived out of this requirement under 19 TAC §89.1205(g)?

   ☐ Yes ☒ No ☐ N/A

5. If the answer is yes to question 1, 2, 3, or 4, public notices in an alternative language are required. Which language is required by the bilingual program? Spanish

f. Plain Language Summary Template – Complete the Plain Language Summary (TCEQ Form 20972) and include as an attachment. Attachment: C

g. Complete one Public Involvement Plan (PIP) Form (TCEQ Form 20960) for each application for a new permit or major amendment and include as an attachment. Attachment: N/A

Item 10. Regulated Entity and Permitted Site Information (Instructions Page 29)

a. TCEQ issued Regulated Entity Number (RN), if available: RN100673490

Note: If your business site is part of a larger business site, a Regulated Entity Number (RN) may already be assigned for the larger site. Use the RN assigned for the larger site. Search the TCEQ's Central Registry to determine the RN or to see if the larger site may already be registered as a Regulated Entity. If the site is found, provide the assigned RN.

b. Name of project or site (the name known by the community where located): Lake Hubbard Steam Electric Station

c. Is the location address of the facility in the existing permit the same?

☒ Yes ☐ No ☐ N/A (new permit)

Note: If the facility is located in Bexar, Comal, Hays, Kinney, Medina, Travis, Uvalde, or Williamson County, additional information concerning protection of the Edwards Aquifer may be required.

d. Owner of treatment facility:

Prefix: Click to enter text. Full Name (Last/First Name): Click to enter text.

or Organization Name: Luminant Generation Company LLC

Mailing Address: 6555 Sierra Drive City/State/Zip: Irving/TX/75039

Phone No: Click to enter text. Email: Click to enter text.

e. Ownership of facility: ☐ Public ☒ Private ☐ Both ☐ Federal

f. Owner of land where treatment facility is or will be: Click to enter text.

Prefix: Click to enter text. Full Name (Last/First Name): Click to enter text.

or Organization Name: Luminant Generation Company LLC

Mailing Address: 6555 Sierra Drive City/State/Zip: Irving, TX, 75039

Phone No: 214-875-8294 Email: ryan.bayle@luminant.com

Note: If not the same as the facility owner, attach a long-term lease agreement in effect for at least six years (In some cases, a lease may not suffice - see instructions). Attachment: N/A

g. Owner of effluent TLAP disposal site (if applicable): N/A

Prefix: Click to enter text. Full Name (Last/First Name): Click to enter text.

or Organization Name: Click to enter text.

Mailing Address: Click to enter text. City/State/Zip: Click to enter text.

Phone No: Click to enter text. Email: Click to enter text.

Note: If not the same as the facility owner, attach a long-term lease agreement in effect for at least six years. Attachment: Click to enter text.

h. Owner of sewage sludge disposal site (if applicable):

Prefix: N/A Full Name (Last/First Name): Click to enter text.

or Organization Name: Click to enter text.

Mailing Address: Click to enter text. City/State/Zip: Click to enter text.

Phone No: Click to enter text. Email: Click to enter text.

Note: If not the same as the facility owner, attach a long-term lease agreement in effect for at least six years. Attachment: Click to enter text.

Item 11. TDPES Discharge/TLAP Disposal Information (Instructions, Page 31)

a. Is the facility located on or does the treated effluent cross Native American Land?

☐ Yes ☒ No

b. Attach an original full size USGS Topographic Map (or an 8.5"×11" reproduced portion for renewal or amendment applications) with all required information. Check the box next to each item below to confirm it has been included on the map.

☒ One-mile radius
☒ Applicant's property boundaries
☒ Labeled point(s) of discharge
☐ Effluent disposal site boundaries
☐ Sewage sludge disposal site
☒ Three-miles downstream information
☐ Treatment facility boundaries
☒ Highlighted discharge route(s)
☐ All wastewater ponds
☐ New and future construction

Attachment: Click to enter text.

c. Is the location of the sewage sludge disposal site in the existing permit accurate?

☐ Yes ☐ No or New Permit

If no, or a new application, provide an accurate location description: N/A

d. Are the point(s) of discharge in the existing permit correct?

☒ Yes ☐ No or New Permit

If no, or a new application, provide an accurate location description: Click to enter text.

e. Are the discharge route(s) in the existing permit correct?

☒ Yes ☐ No or New Permit

If no, or a new permit, provide an accurate description of the discharge route: Click to enter text.

f. City nearest the outfall(s): Sunnyvale, TX

g. County in which the outfalls(s) is/are located: Dallas

h. Is or will the treated wastewater discharge to a city, county, or state highway right-of-way, or a flood control district drainage ditch?

☐ Yes ☒ No

If yes, indicate by a check mark if: ☐ Authorization granted ☐ Authorization pending

For new and amendment applications, attach copies of letters that show proof of contact and provide the approval letter upon receipt. Attachment: Click to enter text.

For all applications involving an average daily discharge of 5 MGD or more, provide the names of all counties located within 100 statute miles downstream of the point(s) of discharge: Dallas, Rockwall, Kaufman, Ellis, Navarro, Henderson, Freestone and Anderson

i. For TLAPs, is the location of the effluent disposal site in the existing permit accurate?

☐ Yes No or New Permit ☒ Click to enter text.

If no, or a new application, provide an accurate location description: N/A

j. City nearest the disposal site: N/A

k. County in which the disposal site is located: N/A

l. For TLAPs, describe how effluent is/will be routed from the treatment facility to the disposal site: N/A

m. For TLAPs, identify the nearest watercourse to the disposal site to which rainfall runoff might flow if not contained: N/A

Item 12: Miscellaneous Information (Instructions, Page 33)

a. Did any person formerly employed by the TCEQ represent your company and get paid for service regarding this application?

☐ Yes ☒ No

If yes, list each person: Click to enter text.

b. Do you owe any fees to the TCEQ?

☐ Yes ☒ No

If yes, provide the following information:

Account no.: Click to enter text.

Total amount due: Click to enter text.

c. Do you owe any penalties to the TCEQ?

☐ Yes ☒ No

If yes, provide the following information:

Enforcement order no.: Click to enter text.

Amount due: Click to enter text.

Item 13. Signature Page (Instructions, Page 33)

Permit No: WQ0001245000

Applicant Name: Luminant Generation Company LLC

Certification: I, Renee Collins, certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code §305.44 to sign and submit this document and can provide documentation in proof of such authorization upon request.

Signatory name (typed or printed): Renee Collins

Signatory title: Click to enter text.

Signature: _____ Date: 8/22/2024
(Use blue ink)

Subscribed and Sworn to before me by the said Renee Collins

on this 22nd day of August, 2024.

My commission expires on the 29th day of August, 2025.

Tish Goodspeed
Notary Public

TISH GOODSPEED
My Notary ID # 129536082
Expires August 29, 2025

[SEAL]

Dallas
County, Texas

Note: *If co-applicants are necessary, each entity must submit an original, separate signature page.*

Vistra Corp.
6555 Sierra Drive
Irving, TX 75039

O 214-875-8996

Texas Commission on Environmental Quality
12100 Park 35 Circle
Austin, Texas 78753

Re: Delegation of Administrative Authority for Vistra Corp.

This letter confirms the signatory authority for environmental matters related to the subsidiary entities of Vistra Operations Company LLC, which is a subsidiary of Vistra Corp.

Vistra Operations Company LLC hereby authorizes Renee Collins, Senior Director – Environmental Services, to act in the following capacities as it relates to administrative issues related to the below listed subsidiaries: Authorized Responsible Official and Alternate Designated Representative; as well, Ms. Collins has signatory authority for all air, water and waste permitting activities, and for water rights and water quality regulatory submissions. Those subsidiaries for which Ms. Collins has signatory authority are: Luminant Mining Company LLC, Luminant Generation Company LLC, La Frontera Holdings, LLC, Sandow Power Company LLC, Oak Grove Management Company LLC, Coleto Creek Power, LLC, Brightside Solar, LLC, Emerald Grove, LLC, and Core Solar SPV I, LLC.

Vistra Operations Company LLC hereby authorizes Renee Collins, Senior Director – Environmental Services, to act in the following capacities as it relates to administrative issues related to the below listed Vistra Corp. subsidiaries: Duly Authorized Representative and Alternate Designated Representative; as well, Ms. Collins has signatory authority for all air, water and waste permitting activities, and for water rights and water quality regulatory submissions. Those subsidiaries for which Ms. Collins has signatory authority are: Ennis Power Company LLC, Hays Energy, LLC and Midlothian Energy, LLC.

Vistra Operations Company LLC hereby authorizes Renee Collins, Senior Director – Environmental Services, to act in the following capacities as it relates to administrative issues related to the below listed Vistra Corp. subsidiaries: Alternate Designated Representative; as well, Ms. Collins has signatory authority for all air, water and waste permitting activities, and for water rights and water quality regulatory submissions. Those subsidiaries for which Ms. Collins has signatory authority are: Wise County Power Company, LLC.

This delegation of authority is effective as of April 22, 2022, supersedes all previous delegations for this responsibility, and is valid until revoked or revised by Vistra Operations Company LLC.

I, Barry Boswell, being Executive Vice President—Generation Operations and Services of Vistra Operations Company LLC, the parent company to each of the above listed entities, and designee in charge of business functions, policy or decision-making functions for solar, battery, and fossil operations, hereby delegate authority, as detailed herein, to Renee Collins, Senior Director – Environmental Services.

Barry Boswell 4/26/2022

Signature Date

cc: David Mitchell – Senior Counsel

INDUSTRIAL WASTEWATER PERMIT APPLICATION CHECKLIST OF COMMON DEFICIENCIES

Below is a list of common deficiencies found during the administrative review of industrial wastewater permit applications. To ensure the timely processing of this application, please review the items below and indicate each item is complete and in accordance applicable rules at 30 TAC Chapters 21, 281, and 305 by checking the box next to the item. If an item is not required this application, indicate by checking N/A where appropriate. Please do not submit the application until all items below are addressed.

☒ Core Data Form (TCEQ Form No. 10400)
(Required for all applications types. Must be completed in its entirety and signed. Note: Form may be signed by applicant representative.)

☒ Correct and Current Industrial Wastewater Permit Application Forms
(TCEQ Form Nos. 10055 and 10411. Version dated 5/10/2019 or later.)

☒ Water Quality Permit Payment Submittal Form (Page 14)
(Original payment sent to TCEQ Revenue Section. See instructions for mailing address.)

☒ 7.5 Minute USGS Quadrangle Topographic Map Attached
(Full-size map if seeking "New" permit. 8 ½ x 11 acceptable for Renewals and Amendments.)

☒ N/A ☐ Current/Non-Expired, Executed Lease Agreement or Easement Attached

☒ N/A ☐ Landowners Map
(See instructions for landowner requirements.)

Things to Know:

- All the items shown on the map must be labeled.
- The applicant's complete property boundaries must be delineated which includes boundaries of contiguous property owned by the applicant.
- The applicant cannot be its own adjacent landowner. You must identify the landowners immediately adjacent to their property, regardless of how far they are from the actual facility.
- If the applicant's property is adjacent to a road, creek, or stream, the landowners on the opposite side must be identified. Although the properties are not adjacent to applicant's property boundary, they are considered potentially affected landowners. If the adjacent road is a divided highway as identified on the USGS topographic map, the applicant does not have to identify the landowners on the opposite side of the highway.

☒ N/A ☐ Landowners Cross Reference List
(See instructions for landowner requirements.)

☒ N/A ☐ Landowners Labels or CD-RW attached
(See instructions for landowner requirements.)

☒ Original signature per 30 TAC § 305.44 - Blue Ink Preferred
(If signature page is not signed by an elected official or principle executive officer, a copy of signature authority/delegation letter must be attached.)

☒ Plain Language Summary

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

INDUSTRIAL WASTEWATER PERMIT APPLICATION TECHNICAL REPORT 1.0

The following information **is required** for all applications for a TLAP or an individual TPDES discharge permit.

For **additional information** or clarification on the requested information, please refer to the Instructions for Completing the Industrial Wastewater Permit Application[1] available on the TCEQ website. Please contact the Industrial Permits Team at 512-239-4671 with any questions about this form.

If more than one outfall is included in the application, provide applicable information for each individual outfall. **If an item does not apply to the facility, enter N/A** to indicate that the item has been considered. Include separate reports or additional sheets as **clearly cross-referenced attachments** and provide the attachment number in the space provided for the item the attachment addresses.

NOTE: This application is for an industrial wastewater permit only. Additional authorizations from the TCEQ Waste Permits Division or the TCEQ Air Permits Division may be needed.

Item 1. Facility/Site Information (Instructions, Page 39)

a. Describe the general nature of the business and type(s) of industrial and commercial activities. Include all applicable SIC codes (up to 4).

Generation of electricity

b. Describe all wastewater-generating processes at the facility.

See attachment F: General Description

[1] https://www.tceq.texas.gov/permitting/wastewater/industrial/TPDES_industrial_wastewater_steps.html

c. Provide a list of raw materials, major intermediates, and final products handled at the facility.

Materials List

Raw Materials	Intermediate Products	Final Products
Water	Steam	Electricity
Natural Gas		
Fuel oil		

Attachment: Click to enter text.

d. Attach a facility map (drawn to scale) with the following information:

- Production areas, maintenance areas, materials-handling areas, waste-disposal areas, and water intake structures.
- The location of each unit of the WWTP including the location of wastewater collection sumps, impoundments, outfalls, and sampling points, if significantly different from outfall locations.

Attachment: D and G: USGS Map and Facility Map

e. Is this a new permit application for an existing facility?

☐ Yes ☒ No

If **yes**, provide background discussion: N/A

f. Is/will the treatment facility/disposal site be located above the 100-year frequency flood level.

☒ Yes ☐ No

List source(s) used to determine 100-year frequency flood plain: FEMA, Flood Insurance Rate Map, Dallas County, Texas, Map No. 48113C0385L, 7/7/2014

If **no**, provide the elevation of the 100-year frequency flood plain and describe what protective measures are used/proposed to prevent flooding (including tail water and rainfall run-on controls) of the treatment facility and disposal area: Click to enter text.

Attachment: Click to enter text.

g. For **new** or **major amendment** permit applications, will any construction operations result in a discharge of fill material into a water in the state?

☐ Yes ☐ No ☒ N/A (renewal only)

h. If **yes** to Item 1.g, has the applicant applied for a USACE CWA Chapter 404 Dredge and Fill permit?

☐ Yes ☐ No

If **yes**, provide the permit number: Click to enter text.

If **no**, provide an approximate date of application submittal to the USACE: Click to enter text.

Item 2. Treatment System (Instructions, Page 40)

a. List any physical, chemical, or biological treatment process(es) used/proposed to treat wastewater at this facility. Include a description of each treatment process, starting with initial treatment and finishing with the outfall/point of disposal.

TREATMENT PROCESS	TREATMENT UNIT	CAPACITY / DIMENSIONS	OUTFALL
1. Oil/Water Separation	Oil/Water Separators (4) Oil Skimmer	O/W Separator No. 1 = 35 72 GPM* O/W Separator No. 2 = 272- 547 GPM* O/W Separator No. 3 = 0– 35 GPM* O/W Separator No. 4 = 0– 72 GPM*	101 101 101 101
* Expected Average Flow Range			
2. Neutralization	Neutralization Basins	2 Basins = 17' x 17" x 18' each	101
For Additional Details See Attachment F General Description.			

b. Attach a flow schematic **with a water balance** showing all sources of water and wastewater flow into the facility, wastewater flow into and from each treatment unit, and wastewater flow to each outfall/point of disposal.

Attachment: F: Water Use Diagram

Item 3. Impoundments (Instructions, Page 40)

Does the facility use or plan to use any wastewater impoundments (e.g., lagoons or ponds?)

☐ Yes ☒ No

If **no**, proceed to Item 4. If **yes**, complete **Item 3.a** for **existing** impoundments and **Items 3.a - 3.e** for **new or proposed** impoundments. **NOTE:** See instructions, Pages 40-42, for additional information on the attachments required by Items 3.a – 3.e.

a. Complete the table with the following information for each existing, new, or proposed impoundment. Attach additional copies of the Impoundment Information table, if needed.

Use Designation: Indicate the use designation for each impoundment as Treatment (**T**), Disposal (**D**), Containment (**C**), or Evaporation (**E**).

Associated Outfall Number: Provide an outfall number if a discharge occurs or will occur.

Liner Type: Indicate the liner type as Compacted clay liner (**C**), In-situ clay liner (**I**), Synthetic/plastic/rubber liner (**S**), or Alternate liner (**A**). **NOTE:** See instructions for further detail on liner specifications. If an alternate liner (A) is selected, include an attachment that provides a description of the alternate liner and any additional technical information necessary for an evaluation.

Leak Detection System: If any leak detection systems are in place/planned, enter **Y** for yes. Otherwise, enter **N** for no.

Groundwater Monitoring Wells and Data: If groundwater monitoring wells are in place/planned, enter **Y** for yes. Otherwise, enter **N** for no. Attach any existing groundwater monitoring data.

Dimensions: Provide the dimensions, freeboard, surface area, storage capacity of the impoundments, and the maximum depth (not including freeboard). For impoundments with irregular shapes, submit surface area instead of length and width.

Compliance with 40 CFR Part 257, Subpart D: If the impoundment is required to be in compliance with 40 CFR Part 257, Subpart D, enter **Y** for yes. Otherwise, enter **N** for no.

Date of Construction: Enter the date construction of the impoundment commenced (mm/dd/yy).

Impoundment Information

Parameter	**Pond #**	**Pond #**	**Pond #**	**Pond #**
Use Designation: (T) (D) (C) or (E)	N/A	N/A	N/A	N/A
Associated Outfall Number				
Liner Type (C) (I) (S) or (A)				
Alt. Liner Attachment Reference				
Leak Detection System, Y/N				
Groundwater Monitoring Wells, Y/N				
Groundwater Monitoring Data Attachment				
Pond Bottom Located Above The Seasonal High-Water Table, Y/N				
Length (ft)				
Width (ft)				
Max Depth From Water Surface (ft), Not Including Freeboard				
Freeboard (ft)				
Surface Area (acres)				
Storage Capacity (gallons)				
40 CFR Part 257, Subpart D, Y/N				
Date of Construction				

Attachment: Click to enter text.

The following information (**Items 3.b – 3.e**) is required only for **new or proposed** impoundments.

b. For new or proposed impoundments, attach any available information on the following items. If attached, check **yes** in the appropriate box. Otherwise, check **no** or **not yet designed.**

1. Liner data

☐ Yes ☐ No ☐ Not yet designed

2. Leak detection system or groundwater monitoring data

☐ Yes ☐ No ☐ Not yet designed

3. Groundwater impacts

☐ Yes ☐ No ☐ Not yet designed

NOTE: Item b.3 is required if the bottom of the pond is not above the seasonal high-water table in the shallowest water-bearing zone.

Attachment: N/A

For TLAP applications: Items 3.c – 3.e are **not required**, continue to Item 4.

c. Attach a USGS map or a color copy of original quality and scale which accurately locates and identifies all known water supply wells and monitor wells within ½-mile of the impoundments.

Attachment: N/A

d. Attach copies of State Water Well Reports (e.g., driller's logs, completion data, etc.), and data on depths to groundwater for all known water supply wells including a description of how the depths to groundwater were obtained.

Attachment: N/A

e. Attach information pertaining to the groundwater, soils, geology, pond liner, etc. used to assess the potential for migration of wastes from the impoundments or the potential for contamination of groundwater or surface water.

Attachment: N/A

Item 4. Outfall/Disposal Method Information (Instructions, Page 42)

Complete the following tables to describe the location and wastewater discharge or disposal operations for each outfall for discharge, and for each point of disposal for TLAP operations.

If there are more outfalls/points of disposal at the facility than the spaces provided, copies of pages 6 and/0r numbered accordingly (i.e., page 6a, 6b, etc.) may be used to provide information on the additional outfalls.

For TLAP applications: Indicate the disposal method and each individual irrigation area **I**, evaporation pond **E**, or subsurface drainage system **S** by providing the appropriate letter designation for the disposal method followed by a numerical designation for each disposal

area in the space provided for **Outfall** number (e.g. **E1** for evaporation pond 1, **I2** for irrigation area No. 2, etc.).

Outfall Longitude and Latitude

Outfall No.	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
001	32.838874	-96.543714
101	(1) 32.825943	-96.544914
	(2) 32.838070	-96.545575
	(3) 32.838360	-96.546071
	(4) 32.838656	-96.546148
	(5) 32.838009	-96.546103
	(6) 32.838009	-96.546103
	(7) 32.838009	-96.546103

Outfall Location Description

Outfall No.	Location Description
001	From the One-Through Cooling Discharge Canal to Lake Ray Hubbard
101	(1) At the discharge weir from Oil Separator No. 1 adjacent to the intake structure (2) At the discharge weir from Oil Separator No. 2 prior to entering the Discharge Canal (3) At the discharge weir from Oil Separator No. 3 prior to entering the Discharge Canal (4) At the discharge weir from Oil Separator No. 4 prior to entering the Discharge Canal (5) At the wastewater treatment plant discharge pipe prior to entering the Discharge Canal (6) At the Unit 1 boiler blowdown discharge line prior to entering the Discharge Canal (7) At the Unit 2 boiler blowdown discharge line prior to entering the Discharge Canal

Description of Sampling Point(s) (if different from Outfall location)

Outfall No.	Description of sampling point

Outfall Flow Information – Permitted and Proposed

Outfall No.	Permitted Daily Avg Flow (MGD)	Permitted Daily Max Flow (MGD)	Proposed Daily Avg Flow (MGD)	Proposed Daily Max Flow (MGD)	Anticipated Discharge Date (mm/dd/yy)
001	870	870	870	870	
101	(1) Report	Report	Report	Report	
101	(2) Report	Report	Report	Report	
101	(3) Report	Report	Report	Report	
101	(4) Report	Report	Report	Report	
101	(5) Report	Report	Report	Report	
101	(6) Report	Report	Report	Report	
101	(7) Report	Report	Report	Report	

Outfall Discharge – Method and Measurement

Outfall No.	Pumped Discharge? Y/N	Gravity Discharge? Y/N	Type of Flow Measurement Device Used
001	Y	N	Record
101	(1) N	Y	Estimate
	(2) N	Y	Estimate
	(3) N	Y	Estimate
	(4) N	Y	Estimate
	(5) Y	N	Estimate
	(6) N	Y	Estimate
	(7) N	Y	Estimate

Outfall Discharge – Flow Characteristics

Outfall No.	Intermittent Discharge? Y/N	Continuous Discharge? Y/N	Seasonal Discharge? Y/N	Discharge Duration (hrs/day)	Discharge Duration (days/mo)	Discharge Duration (mo/yr)
001	N	N	Y	24	30/31	12
101	(1) N	N	Y	24	30/31	12
	(2) N	N	Y	24	30/31	12
	(3) Y	N	N	Variable	Variable	Variable
	(4) Y	N	N	Variable	Variable	Variable
	(5) Y	N	N	Variable	Variable	Variable
	(6) Y	N	N	Variable	Variable	Variable
	(7) Y	N	N	Variable	Variable	Variable

Outfall Wastestream Contributions

Outfall No. **001**

Contributing Wastestream	Volume (MGD)	Percent (%) of Total Flow
Once-Through cooling	870	100

Contributing Wastestream	Volume (MGD)	Percent (%) of Total Flow
Auxiliary cooling water	870	100
Previously monitored effluent from outfall 101		

Outfall No. **101**

Contributing Wastestream	Volume (MGD)	Percent (%) of Total Flow
Low Volume Wastes	Variable	Variable
Metal Cleaning Wastes	Variable	Variable
Storm water runoff (from diked oil storage areas, yard and storm drains)	Variable	Variable

Outfall No. Click to enter text.

Contributing Wastestream	Volume (MGD)	Percent (%) of Total Flow

Attachment: Click to enter text.

Item 5. Blowdown and Once-Through Cooling Water Discharges (Instructions, Page 43)

a. Indicate if the facility currently or proposes to:

☒ Yes ☐ No Use cooling towers that discharge blowdown or other wastestreams

☒ Yes ☐ No Use boilers that discharge blowdown or other wastestreams

☒ Yes ☐ No Discharge once-through cooling water

NOTE: If the facility uses or plans to use cooling towers or once-through cooling water, Item 12 **is required.**

b. If **yes** to any of the above, attach an SDS with the following information for each chemical additive.

- Manufacturers Product Identification Number
- Product use (e.g., biocide, fungicide, corrosion inhibitor, etc.)
- Chemical composition including CASRN for each ingredient
- Classify product as non-persistent, persistent, or bioaccumulative
- Product or active ingredient half-life
- Frequency of product use (e.g., 2 hours/day once every two weeks)
- Product toxicity data specific to fish and aquatic invertebrate organisms
- Concentration of whole product or active ingredient, as appropriate, in wastestream.

In addition to each SDS, attach a summary of the above information for each specific wastestream and the associated chemical additives. Specify which outfalls are affected.

Attachment: I and J: Boiler Chemical Additives & Once-through Cooling Chemical Additives

c. Cooling Towers and Boilers

If the facility currently or proposes to use cooling towers or boilers that discharge blowdown or other wastestreams to the outfall(s), complete the following table.

Cooling Towers and Boilers

Type of Unit	Number of Units	Daily Avg Blowdown (gallons/day)	Daily Max Blowdown (gallons/day)
Cooling Towers	0	N/A	N/A
Boilers	2	20,000	170,000

Item 6. Stormwater Management (Instructions, Page 44)

Will any existing/proposed outfalls discharge stormwater associated with industrial activities, as defined at *40 CFR § 122.26(b)(14)*, commingled with any other wastestream?

☒ Yes ☐ No

If **yes**, briefly describe the industrial processes and activities that occur outdoors or in a manner which may result in exposure of the activities or materials to stormwater: See attachment F: General Description

Item 7. Domestic Sewage, Sewage Sludge, and Septage Management and Disposal (Instructions, Page 44)

Domestic Sewage - Waste and wastewater from humans or household operations that is discharged to a wastewater collection system or otherwise enters a treatment works.

a. Check the box next to the appropriate method of domestic sewage and domestic sewage sludge treatment or disposal. Complete Worksheet 5.0 or Item 7.b if directed to do so.

☒ Domestic sewage is routed (i.e., connected to or transported to) to a WWTP permitted to receive domestic sewage for treatment, disposal, or both. Complete Item 7.b.

☐ Domestic sewage disposed of by an on-site septic tank and drainfield system. Complete Item 7.b.

☐ Domestic and industrial treatment sludge ARE commingled prior to use or disposal.

☐ Industrial wastewater and domestic sewage are treated separately, and the respective sludge IS NOT commingled prior to sludge use or disposal. Complete Worksheet 5.0.

☐ Facility is a POTW. Complete Worksheet 5.0.

☐ Domestic sewage is not generated on-site.

☐ Other (e.g., portable toilets), specify and Complete Item 7.b: Click to enter text.

b. Provide the name and TCEQ, NPDES, or TPDES Permit No. of the waste-disposal facility which receives the domestic sewage/septage. If hauled by motorized vehicle, provide the name and TCEQ Registration No. of the hauler.

Domestic Sewage Plant/Hauler Name

Plant/Hauler Name	Permit/Registration No.
Duck Creek WWTP	WQ0010090001

Item 8. Improvements or Compliance/Enforcement Requirements (Instructions, Page 45)

a. Is the permittee currently required to meet any implementation schedule for compliance or enforcement?

☐ Yes ☒ No

b. Has the permittee completed or planned for any improvements or construction projects?

☐ Yes ☒ No

c. If **yes** to either 8.a **or** 8.b, provide a brief summary of the requirements and a status update: Click to enter text.

Item 9. Toxicity Testing (Instructions, Page 45)

Have any biological tests for acute or chronic toxicity been made on any of the discharges or on a receiving water in relation to the discharge within the last three years?

☒ Yes ☐ No

If **yes**, identify the tests and describe their purposes: Chronic and 24-hour Acute Biomonitoring of Outfall 001 and Outfall 002 is done once per six months as required by the current permit. All test results have been previously submitted to the TCEQ.

Additionally, attach a copy of all tests performed which **have not** been submitted to the TCEQ or EPA. **Attachment:** Click to enter text.

Item 10. Off-Site/Third Party Wastes (Instructions, Page 45)

a. Does or will the facility receive wastes from off-site sources for treatment at the facility, disposal on-site via land application, or discharge via a permitted outfall?

☐ Yes ☒ No

If **yes**, provide responses to Items 10.b through 10.d below.

If **no**, proceed to Item 11.

b. Attach the following information to the application:

- List of wastes received (including volumes, characterization, and capability with on-site wastes).
- Identify the sources of wastes received (including the legal name and addresses of the generators).
- Description of the relationship of waste source(s) with the facility's activities.

Attachment: Click to enter text.

c. Is or will wastewater from another TCEQ, NPDES, or TPDES permitted facility commingled with this facility's wastewater after final treatment and prior to discharge via the final outfall/point of disposal?

☐ Yes ☐ No

If **yes**, provide the name, address, and TCEQ, NPDES, or TPDES permit number of the contributing facility and a copy of any agreements or contracts relating to this activity.

Attachment: Click to enter text.

d. Is this facility a POTW that accepts/will accept process wastewater from any SIU and has/is required to have an approved pretreatment program under the NPDES/TPDES program?

☐ Yes ☐ No

If **yes, Worksheet 6.0** of this application **is required.**

Item 11. Radioactive Materials (Instructions, Page 46)

a. Are/will radioactive materials be mined, used, stored, or processed at this facility?

☐ Yes ☒ No

If **yes**, use the following table to provide the results of one analysis of the effluent for all radioactive materials that may be present. Provide results in pCi/L.

Radioactive Materials Mined, Used, Stored, or Processed

Radioactive Material Name	Concentration (pCi/L)

b. Does the applicant or anyone at the facility have any knowledge or reason to believe that radioactive materials may be present in the discharge, including naturally occurring radioactive materials in the source waters or on the facility property?

☐ Yes ☒ No

If **yes**, use the following table to provide the results of one analysis of the effluent for all radioactive materials that may be present. Provide results in pCi/L. Do not include information provided in response to Item 11.a.

Radioactive Materials Present in the Discharge

Radioactive Material Name	Concentration (pCi/L)

Item 12. Cooling Water (Instructions, Page 46)

a. Does the facility use or propose to use water for cooling purposes?

☒ Yes ☐ No

If **no**, stop here. If **yes**, complete Items 12.b thru 12.f.

b. Cooling water is/will be obtained from a groundwater source (e.g., on-site well).

☐ Yes ☒ No

If **yes**, stop here. If **no**, continue.

c. Cooling Water Supplier

1. Provide the name of the owner(s) and operator(s) for the CWIS that supplies or will supply water for cooling purposes to the facility.

Cooling Water Intake Structure(s) Owner(s) and Operator(s)

CWIS ID	LH CWIS #1			
Owner	Luminant Generation Company LLC			
Operator	Luminant Generation Company LLC			

2. Cooling water is/will be obtained from a Public Water Supplier (PWS)

☐ Yes ☒ No

If **no**, continue. If **yes**, provide the PWS Registration No. and stop here: PWS No. Click to enter text.

3. Cooling water is/will be obtained from a reclaimed water source?

☐ Yes ☒ No

If **no**, continue. If **yes**, provide the Reuse Authorization No. and stop here: Click to enter text.

4. Cooling water is/will be obtained from an Independent Supplier

☐ Yes ☒ No

If **no**, proceed to Item 12.d. If **yes**, provide the actual intake flow of the Independent Supplier's CWIS that is/will be used to provide water for cooling purposes and proceed: Click to enter text.

d. 316(b) General Criteria

1. The CWIS(s) used to provide water for cooling purposes to the facility has or will have a cumulative design intake flow of 2 MGD or greater.

☒ Yes ☐ No

2. At least 25% of the total water withdrawn by the CWIS is/will be used at the facility exclusively for cooling purposes on an annual average basis.

☒ Yes ☐ No

3. The CWIS(s) withdraw(s)/propose(s) to withdraw water for cooling purposes from surface waters that meet the definition of Waters of the United States in *40 CFR § 122.2*.

☒ Yes ☐ No

If **no**, provide an explanation of how the waterbody does not meet the definition of Waters of the United States in *40 CFR § 122.2*: Click to enter text.

If **yes** to all three questions in Item 12.d, the facility **meets** the minimum criteria to be subject to the full requirements of Section 316(b) of the CWA. Proceed to **Item 12.f.**

If **no** to any of the questions in Item 12.d, the facility **does not meet** the minimum criteria to be subject to the full requirements of Section 316(b) of the CWA; however, a determination is required based upon BPJ. Proceed to **Item 12.e.**

e. The facility does not meet the minimum requirements to be subject to the fill requirements of Section 316(b) **and uses**/proposes **to use cooling towers.**

☐ Yes ☐ No

If **yes**, stop here. If **no**, complete Worksheet 11.0, Items 1.a, 1.b.1-3 and 6, 2.b.1, and 3.a to allow for a determination based upon BPJ.

f. Oil and Gas Exploration and Production

1. The facility is subject to requirements at 40 CFR Part 435, Subparts A or D.

☐ Yes ☐ No

If **yes**, continue. If **no**, skip to Item 12.g.

2. The facility is an existing facility as defined at 40 CFR § 125.92(k) or a new unit at an existing facility as defined at 40 CFR § 125.92(u).

☐ Yes ☐ No

If **yes**, complete Worksheet 11.0, Items 1.a, 1.b.1-3 and 6, 2.b.1, and 3.a to allow for a determination based upon BPJ. If **no**, skip to Item 12.g.3.

g. Compliance Phase and Track Selection

1. Phase I – New facility subject to 40 CFR Part 125, Subpart I

☐ Yes ☐ No

If **yes**, check the box next to the compliance track selection, attach the requested information, and complete Worksheet 11.0, Items 2 and 3, and Worksheet 11.2.

☐ Track I – AIF greater than 2 MGD, but less than 10 MGD

- Attach information required by *40 CFR §§ 125.86(b)(2)-(4).*

☐ Track I – AIF greater than 10 MGD

- Attach information required by *40 CFR § 125.86(b).*

☐ Track II

- Attach information required by *40 CFR § 125.86(c).*

Attachment: Click to enter text.

2. Phase II – Existing facility subject to 40 CFR Part 125, Subpart J

☐ Yes ☐ No

If **yes**, complete Worksheets 11.0 through 11.3, as applicable.

3. Phase III – New facility subject to 40 CFR Part 125, Subpart N

☐ Yes ☐ No

If **yes**, check the box next to the compliance track selection and provide the requested information.

☐ Track I – Fixed facility

- Attach information required by 40 CFR § 125.136(b) and complete Worksheet 11.0, Items 2 and 3, and Worksheet 11.2.

☐ Track I – Not a fixed facility

- Attach information required by 40 CFR § 125.136(b) and complete Worksheet 11.0, Item 2 (except CWIS latitude/longitude under Item 2.a).

☐ Track II – Fixed facility

- Attach information required by 40 CFR § 125.136(c) and complete Worksheet 11.0, Items 2 and 3.

Attachment: Click to enter text.

Item 13. Permit Change Requests (Instructions, Page 48)

This item is only applicable to existing permitted facilities.

a. Is the facility requesting a **major amendment** of an existing permit?

☐ Yes ☒ No

If **yes,** list each request individually and provide the following information: 1) detailed information regarding the scope of each request and 2) a justification for each request. Attach any supplemental information or additional data to support each request.

Click to enter text.

b. Is the facility requesting any **minor amendments** to the permit?

☐ Yes ☒ No

If **yes,** list and describe each change individually.

Click to enter text.

c. Is the facility requesting any **minor modifications** to the permit?

☐ Yes ☒ No

If **yes,** list and describe each change individually.

Click to enter text.

Item 14. Laboratory Accreditation (Instructions, Page 49)

All laboratory tests performed must meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification,* which includes the following general exemptions from National Environmental Laboratory Accreditation Program (NELAP) certification requirements:

- The laboratory is an in-house laboratory and is:
  - periodically inspected by the TCEQ; or
  - located in another state and is accredited or inspected by that state; or
  - performing work for another company with a unit located in the same site; or
  - performing pro bono work for a governmental agency or charitable organization.
- The laboratory is accredited under federal law.
- The data are needed for emergency-response activities, and a laboratory accredited under the Texas Laboratory Accreditation Program is not available.
- The laboratory supplies data for which the TCEQ does not offer accreditation.

The applicant should review *30 TAC Chapter 25* for specific requirements.

The following certification statement shall be signed and submitted with every application. See the *Signature Page* section in the Instructions, for a list of designated representatives who may sign the certification.

CERTIFICATION:

I certify that all laboratory tests submitted with this application meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification.*

Printed Name: Renee Collins

Title: Sr. Director Environmental Services

Signature: Renee Collins

Date: 8/22/2024

INDUSTRIAL WASTEWATER PERMIT APPLICATION WORKSHEET 1.0: EPA CATEGORICAL EFFLUENT GUIDELINES

This worksheet **is required** for all applications for TPDES permits for discharges of wastewaters subject to EPA categorical effluent limitation guidelines (ELGs).

Item 1. Categorical Industries (Instructions, Page 53)

Is this facility subject to any 40 CFR categorical ELGs outlined on page 53 of the instructions?

☒ Yes ☐ No

If **no**, this worksheet is not required. If **yes**, provide the appropriate information below.

40 CFR Effluent Guideline

Industry	40 CFR Part
Steam Electric Power Generation	423

Item 2. Production/Process Data (Instructions, Page 54)

NOTE: For all TPDES permit applications requesting individual permit coverage for discharges of oil and gas exploration and production wastewater (discharges into or adjacent to water in the state, falling under the Oil and Gas Extraction Effluent Guidelines - 40 CFR Part 435), see Worksheet 12.0, Item 2 instead.

a. Production Data

Provide appropriate data for effluent guidelines with production-based effluent limitations.

Production Data

Subcategory	Actual Quantity/Day	Design Quantity/Day	Units
N/A			

b. Organic Chemicals, Plastics, and Synthetic Fibers Manufacturing Data (40 CFR Part 414)

Provide each applicable subpart and the percent of total production. Provide data for metal-bearing and cyanide-bearing wastestreams, as required by *40 CFR Part 414, Appendices A and B.*

Percentage of Total Production

Subcategory	Percent of Total Production	Appendix A and B - Metals	Appendix A - Cyanide
N/A			

c. Refineries (40 CFR Part 419)

Provide the applicable subcategory and a brief justification.

N/A

Item 3. Process/Non-Process Wastewater Flows (Instructions, Page 54)

Provide a breakdown of wastewater flow(s) generated by the facility, including both process and non-process wastewater flow(s). Specify which wastewater flows are to be authorized for discharge under this permit and the disposal practices for wastewater flows, excluding domestic, which are not to be authorized for discharge under this permit.

PROCESS WASTEWATER
low volume waste sources
chemical metal cleaning wastes
non-chemical metal cleaning wastes

NON-PROCESS WASTEWATER
once-through cooling water

Item 4. New Source Determination (Instructions, Page 54)

Provide a list of all wastewater-generating processes subject to EPA categorical ELGs, identify the appropriate guideline Part and Subpart, and provide the date the process/construction commenced.

Wastewater Generating Processes Subject to Effluent Guidelines

Process	EPA Guideline Part	EPA Guideline Subpart	Date Process/ Construction Commenced
low volume waste sources	423	N/A	1970
chemical metal cleaning wastes	423	N/A	1970
non-chemical metal cleaning wastes	423	N/A	1970
once-through cooling water	423	N/A	1970

INDUSTRIAL WASTEWATER PERMIT APPLICATION WORKSHEET 2.0: POLLUTANT ANALYSIS

Worksheet 2.0 **is required** for all applications submitted for a TPDES permit. Worksheet 2.0 is not required for applications for a permit to dispose of all wastewater by land disposal or for discharges solely of stormwater associated with industrial activities.

Item 1. General Testing Requirements (Instructions, Page 55)

a. Provide the date range of all sampling events conducted to obtain the analytical data submitted with this application (e.g., 05/01/2018-05/30/2018): 07/16/2024-08/06/2024

b. ☒ Check the box to confirm all samples were collected no more than 12 months prior to the date of application submittal.

c. Read the general testing requirements in the instructions for important information about sampling, test methods, and MALs. If a contact laboratory was used, attach a list which includes the name, contact information, and pollutants analyzed for each laboratory/firm. **Attachment:** K

Item 2. Specific Testing Requirements (Instructions, Page 56)

Attach correspondence from TCEQ approving submittal of less than the required number of samples, if applicable. **Attachment:** Click to enter text.

TABLE 1 and TABLE 2 (Instructions, Page 58)

Completion of Tables 1 and 2 is required for all external outfalls for all TPDES permit applications.

Table 1 for Outfall No.: 001 **Samples are (check one):** ☐ **Composite** ☒ **Grab**

Pollutant	Sample 1 (mg/L)	Sample 2 (mg/L)	Sample 3 (mg/L)	Sample 4 (mg/L)
BOD (5-day)	<2	<2	<2	<2
CBOD (5-day)	<2	<2	<2	<2
Chemical oxygen demand	31.3	34.8	<25	<25
Total organic carbon	4.08	4.86	2.13	4.01
Dissolved oxygen	6.3	5.96	6.9	4.9
Ammonia nitrogen	<0.2	<0.2	<0.2	<0.2
Total suspended solids	10	13.8	9.7	6.4
Nitrate nitrogen	<0.1	<0.1	<0.1	<0.1
Total organic nitrogen	0.34	0.64	0.50	0.77
Total phosphorus	0.05	0.06	<0.01	0.01
Oil and grease	<10	<10	<10	<10
Total residual chlorine	0.07	0.07	0.13	0.18

Pollutant	Sample 1 (mg/L)	Sample 2 (mg/L)	Sample 3 (mg/L)	Sample 4 (mg/L)
Total dissolved solids	195	195	190	210
Sulfate	29.1	28.6	29.2	30.0
Chloride	21.1	22.0	21.4	2.7
Fluoride	0.45	0.45	0.44	0.53
Total alkalinity (mg/L as CaCO3)	128	200	80	16
Temperature (°F)	96	88	89	91
pH (standard units)	8.1	82	8.2	8.20

Table 2 for Outfall No.: 001 Samples are (check one): ☐ Composite ☒ Grab

Pollutant	Sample 1 (µg/L)	Sample 2 (µg/L)	Sample 3 (µg/L)	Sample 4 (µg/L)	MAL (µg/L)
Aluminum, total	133.49	139.8	107.77	102.74	2.5
Antimony, total	<5	<5	<5	<5	5
Arsenic, total	5.26	5.69	5.45	5.1	0.5
Barium, total	41.2	59.9	46	56.1	3
Beryllium, total	<0.5	<0.5	<0.5	<0.5	0.5
Cadmium, total	<1	<1	<1	<1	1
Chromium, total	<3	<3	<3	<3	3
Chromium, hexavalent	<3	<3	<3	<3	3
Chromium, trivalent	<3	<3	<3	<3	N/A
Copper, total	<0.5	0.79	<0.5	<0.5	2
Cyanide, available	<10	<10	<10	<10	2/10
Lead, total	<0.5	<0.5	<0.5	<0.5	0.5
Mercury, total	<0.005	<0.005	<0.005	<0.005	0.005/0.0005
Nickel, total	1.55	1.85	1.23	1.6	2
Selenium, total	<5	<5	<5	<5	5
Silver, total	<0.5	<0.5	<0.5	<0.5	0.5
Thallium, total	<0.5	<0.5	<0.5	<0.5	0.5
Zinc, total	5.6	9.8	<5	<5	5.0

TABLE 3 (Instructions, Page 58)

Completion of Table 3 **is required** for all **external outfalls** which discharge process wastewater.

Partial completion of Table 3 **is required** for all **external outfalls** which discharge non-process wastewater and stormwater associated with industrial activities commingled with other wastestreams (see instructions for additional guidance).

Table 3 for Outfall No.: **001** Samples are (check one): ☐ Composite ☒ Grab

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)*
Acrylonitrile	<50	<50	<50	<50	50
Anthracene	NA	NA	NA	NA	10
Benzene	<10	<10	<10	<10	10
Benzidine	NA	NA	NA	NA	50
Benzo(a)anthracene	NA	NA	NA	NA	5
Benzo(a)pyrene	NA	NA	NA	NA	5
Bis(2-chloroethyl)ether	NA	NA	NA	NA	10
Bis(2-ethylhexyl)phthalate	<10	<10	<10	<10	10
Bromodichloromethane [Dichlorobromomethane]	<10	<10	<10	<10	10
Bromoform	<10	<10	<10	<10	10
Carbon tetrachloride	<2	<2	<2	<2	2
Chlorobenzene	<10	<10	<10	<10	10
Chlorodibromomethane [Dibromochloromethane]	<10	<10	<10	<10	10
Chloroform	<10	<10	<10	<10	10
Chrysene	NA	NA	NA	NA	5
m-Cresol [3-Methylphenol]	NA	NA	NA	NA	10
o-Cresol [2-Methylphenol]	NA	NA	NA	NA	10
p-Cresol [4-Methylphenol]	NA	NA	NA	NA	10
1,2-Dibromoethane	NA	NA	NA	NA	10
m-Dichlorobenzene [1,3-Dichlorobenzene]	NA	NA	NA	NA	10
o-Dichlorobenzene [1,2-Dichlorobenzene]	NA	NA	NA	NA	10
p-Dichlorobenzene [1,4-Dichlorobenzene]	NA	NA	NA	NA	10
3,3'-Dichlorobenzidine	NA	NA	NA	NA	5
1,2-Dichloroethane	<10	<10	<10	<10	10

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)*
1,1-Dichloroethene [1,1-Dichloroethylene]	<10	<10	<10	<10	10
Dichloromethane [Methylene chloride]	NA	NA	NA	NA	20
1,2-Dichloropropane	<10	<10	<10	<10	10
1,3-Dichloropropene [1,3-Dichloropropylene]	<10	<10	<10	<10	10
2,4-Dimethylphenol	NA	NA	NA	NA	10
Di-n-Butyl phthalate	NA	NA	NA	NA	10
Ethylbenzene	<10	<10	<10	<10	10
Fluoride	450	450	440	530	500
Hexachlorobenzene	NA	NA	NA	NA	5
Hexachlorobutadiene	NA	NA	NA	NA	10
Hexachlorocyclopentadiene	NA	NA	NA	NA	10
Hexachloroethane	NA	NA	NA	NA	20
Methyl ethyl ketone	<50	<50	<50	<50	50
Nitrobenzene	NA	NA	NA	NA	10
N-Nitrosodiethylamine	NA	NA	NA	NA	20
N-Nitroso-di-n-butylamine	NA	NA	NA	NA	20
Nonylphenol	NA	NA	NA	NA	333
Pentachlorobenzene	NA	NA	NA	NA	20
Pentachlorophenol	NA	NA	NA	NA	5
Phenanthrene	NA	NA	NA	NA	10
Polychlorinated biphenyls (PCBs) (**)	<0.2	<0.2	<0.2	<0.2	0.2
Pyridine	<20	<20	<20	<20	20
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	20
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	10
Tetrachloroethene [Tetrachloroethylene]	<10	<10	<10	<10	10
Toluene	<10	<10	<10	<10	10
1,1,1-Trichloroethane	<10	<10	<10	<10	10
1,1,2-Trichloroethane	<10	<10	<10	<10	10
Trichloroethene [Trichloroethylene]	<10	<10	<10	<10	10

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)*
2,4,5-Trichlorophenol	NA	NA	NA	NA	50
TTHM (Total trihalomethanes)	<10	<10	<10	<10	10
Vinyl chloride	<10	<10	<10	<10	10

(*) Indicate units if different from µg/L.

(**) Total of detects for PCB-1242, PCB-1254, PCB-1221, PCB-1232, PCB-1248, PCB-1260, and PCB-1016. If all non-detects, enter the highest non-detect preceded by a "<".

TABLE 4 (Instructions, Pages 58-59)

Partial completion of Table 4 **is required** for each **external outfall** based on the conditions below.

a. **Tributyltin**

Is this facility an industrial/commercial facility which currently or proposes to directly dispose of wastewater from the types of operations listed below or a domestic facility which currently or proposes to receive wastewater from the types of industrial/commercial operations listed below?

☐ Yes ☒ No

If **yes**, check the box next to each of the following criteria which apply and provide the appropriate testing results in Table 4 below (check all that apply).

☐ Manufacturers and formulators of tributyltin or related compounds.

☐ Painting of ships, boats and marine structures.

☐ Ship and boat building and repairing.

☐ Ship and boat cleaning, salvage, wrecking and scaling.

☐ Operation and maintenance of marine cargo handling facilities and marinas.

☐ Facilities engaged in wood preserving.

☐ Any other industrial/commercial facility for which tributyltin is known to be present, or for which there is any reason to believe that tributyltin may be present in the effluent.

b. **Enterococci (discharge to saltwater)**

This facility discharges/proposes to discharge directly into saltwater receiving waters **and** Enterococci bacteria are expected to be present in the discharge based on facility processes.

☐ Yes ☒ No

Domestic wastewater is/will be discharged.

☐ Yes ☒ No

If **yes to either** question, provide the appropriate testing results in Table 4 below.

c. **E. coli (discharge to freshwater)**

This facility discharges/proposes to discharge directly into freshwater receiving waters **and** *E. coli* bacteria are expected to be present in the discharge based on facility processes.

☐ Yes ☒ No

Domestic wastewater is/will be discharged.

☐ Yes ☒ No

If **yes to either** question, provide the appropriate testing results in Table 4 below.

Table 4 for Outfall No.: 001 **Samples are (check one): ☐ Composite ☐ Grab**

Pollutant	Sample 1	Sample 2	Sample 3	Sample 4	MAL
Tributyltin (µg/L)	N/A	N/A	N/A	N/A	0.010
Enterococci (cfu or MPN/100 mL)	N/A	N/A	N/A	N/A	N/A
E. coli (cfu or MPN/100 mL)	N/A	N/A	N/A	N/A	N/A

TABLE 5 (Instructions, Page 59)

Completion of Table 5 **is required** for all **external outfalls** which discharge process wastewater from a facility which manufactures or formulates pesticides or herbicides or other wastewaters which may contain pesticides or herbicides.

If this facility does not/will not manufacture or formulate pesticides or herbicides and does not/will not discharge other wastewaters that may contain pesticides or herbicides, check N/A.

☒ N/A

Table 5 for Outfall No.: N/A **Samples are (check one): ☐ Composite ☐ Grab**

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)*
Aldrin	N/A	N/A	N/A	N/A	0.01
Carbaryl	N/A	N/A	N/A	N/A	5
Chlordane	N/A	N/A	N/A	N/A	0.2
Chlorpyrifos	N/A	N/A	N/A	N/A	0.05
4,4'-DDD	N/A	N/A	N/A	N/A	0.1
4,4'-DDE	N/A	N/A	N/A	N/A	0.1
4,4'-DDT	N/A	N/A	N/A	N/A	0.02
2,4-D	N/A	N/A	N/A	N/A	0.7
Danitol [Fenpropathrin]	N/A	N/A	N/A	N/A	—
Demeton	N/A	N/A	N/A	N/A	0.20
Diazinon	N/A	N/A	N/A	N/A	0.5/0.1
Dicofol [Kelthane]	N/A	N/A	N/A	N/A	1
Dieldrin	N/A	N/A	N/A	N/A	0.02
Diuron	N/A	N/A	N/A	N/A	0.090

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)*
Endosulfan I (*alpha*)	N/A	N/A	N/A	N/A	0.01
Endosulfan II (*beta*)	N/A	N/A	N/A	N/A	0.02
Endosulfan sulfate	N/A	N/A	N/A	N/A	0.1
Endrin	N/A	N/A	N/A	N/A	0.02
Guthion [Azinphos methyl]	N/A	N/A	N/A	N/A	0.1
Heptachlor	N/A	N/A	N/A	N/A	0.01
Heptachlor epoxide	N/A	N/A	N/A	N/A	0.01
Hexachlorocyclohexane (*alpha*)	N/A	N/A	N/A	N/A	0.05
Hexachlorocyclohexane (*beta*)	N/A	N/A	N/A	N/A	0.05
Hexachlorocyclohexane (*gamma*) [Lindane]	N/A	N/A	N/A	N/A	0.05
Hexachlorophene	N/A	N/A	N/A	N/A	10
Malathion	N/A	N/A	N/A	N/A	0.1
Methoxychlor	N/A	N/A	N/A	N/A	2.0
Mirex	N/A	N/A	N/A	N/A	0.02
Parathion (ethyl)	N/A	N/A	N/A	N/A	0.1
Toxaphene	N/A	N/A	N/A	N/A	0.3
2,4,5-TP [Silvex]	N/A	N/A	N/A	N/A	0.3

* Indicate units if different from µg/L.

TABLE 6 (Instructions, Page 59)

Completion of Table 6 **is required** for all **external outfalls.**

Table 6 for Outfall No.: **001** Samples are (check one): ☐ Composite ☒ Grab

Pollutants	Believed Present	Believed Absent	Sample 1 (mg/L)	Sample 2 (mg/L)	Sample 3 (mg/L)	Sample 4 (mg/L)	MAL (µg/L)*
Bromide	☐	☒	<0.2				400
Color (PCU)	☒	☐	50				—
Nitrate-Nitrite (as N)	☐	☒	<0.1				—
Sulfide (as S)	☐	☒	<0.1				—
Sulfite (as SO3)	☐	☒	<2				—
Surfactants	☐	☒	<0.05				—
Boron, total	☐	☒	<1				20
Cobalt, total	☐	☒	<0.0003				0.3
Iron, total	☒	☐	0.16				7
Magnesium, total	☒	☐	3.93				20
Manganese, total	☒	☐	0.0487				0.5
Molybdenum, total	☒	☐	0.0013				1
Tin, total	☐	☒	<0.005				5
Titanium, total	☐	☒	<0.005				30

TABLE 7 (Instructions, Page 60)

Check the box next to any of the industrial categories applicable to this facility. If no categories are applicable, check N/A. If GC/MS testing is required, check the box provided to confirm the testing results for the appropriate parameters are provided with the application.

☐ N/A

Table 7 for Applicable Industrial Categories

Industrial Category	40 CFR Part	Volatiles Table 8	Acids Table 9	Bases/ Neutrals Table 10	Pesticides Table 11
☐ Adhesives and Sealants		☐ Yes	☐ Yes	☐ Yes	No
☐ Aluminum Forming	467	☐ Yes	☐ Yes	☐ Yes	No
☐ Auto and Other Laundries		☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Battery Manufacturing	461	☐ Yes	No	☐ Yes	No
☐ Coal Mining	434	No	No	No	No
☐ Coil Coating	465	☐ Yes	☐ Yes	☐ Yes	No
☐ Copper Forming	468	☐ Yes	☐ Yes	☐ Yes	No
☐ Electric and Electronic Components	469	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Electroplating	413	☐ Yes	☐ Yes	☐ Yes	No
☐ Explosives Manufacturing	457	No	☐ Yes	☐ Yes	No
☐ Foundries		☐ Yes	☐ Yes	☐ Yes	No
☐ Gum and Wood Chemicals - Subparts A,B,C,E	454	☐ Yes	☐ Yes	No	No
☐ Gum and Wood Chemicals - Subparts D,F	454	☐ Yes	☐ Yes	☐ Yes	No
☐ Inorganic Chemicals Manufacturing	415	☐ Yes	☐ Yes	☐ Yes	No
☐ Iron and Steel Manufacturing	420	☐ Yes	☐ Yes	☐ Yes	No
☐ Leather Tanning and Finishing	425	☐ Yes	☐ Yes	☐ Yes	No
☐ Mechanical Products Manufacturing		☐ Yes	☐ Yes	☐ Yes	No
☐ Nonferrous Metals Manufacturing	421,471	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Oil and Gas Extraction - Subparts A, D, E, F, G, H	435	☒ Yes	☒ Yes	☐ Yes	No
☐ Ore Mining - Subpart B	440	No	☐ Yes	No	No
☐ Organic Chemicals Manufacturing	414	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Paint and Ink Formulation	446,447	☐ Yes	☐ Yes	☐ Yes	No
☐ Pesticides	455	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Petroleum Refining	419	☐ Yes	No	No	No
☐ Pharmaceutical Preparations	439	☐ Yes	☐ Yes	☐ Yes	No
☐ Photographic Equipment and Supplies	459	☐ Yes	☐ Yes	☐ Yes	No
☐ Plastic and Synthetic Materials Manufacturing	414	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Plastic Processing	463	☐ Yes	No	No	No
☐ Porcelain Enameling	466	No	No	No	No
☐ Printing and Publishing		☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Pulp and Paperboard Mills - Subpart C	430	☐ *	☐ Yes	☐ *	☐ Yes
☐ Pulp and Paperboard Mills - Subparts F, K	430	☐ *	☐ Yes	☐ *	☐ *
☐ Pulp and Paperboard Mills - Subparts A, B, D, G, H	430	☐ Yes	☐ Yes	☐ *	☐ *
☐ Pulp and Paperboard Mills - Subparts I, J, L	430	☐ Yes	☐ Yes	☐ *	☐ Yes
☐ Pulp and Paperboard Mills - Subpart E	430	☐ Yes	☐ Yes	☐ Yes	☐ *
☐ Rubber Processing	428	☐ Yes	☐ Yes	☐ Yes	No
☐ Soap and Detergent Manufacturing	417	☐ Yes	☐ Yes	☐ Yes	No
☒ Steam Electric Power Plants	423	☒ Yes	☒ Yes	No	No
☐ Textile Mills (Not Subpart C)	410	☐ Yes	☐ Yes	☐ Yes	No
☐ Timber Products Processing	429	☐ Yes	☐ Yes	☐ Yes	☐ Yes

* Test if believed present.

TABLES 8, 9, 10, and 11 (Instructions, Page 60)

Completion of Tables 8, 9, 10, and 11 **is required** as specified in Table 7 for all **external outfalls** that contain process wastewater.

Completion of Tables 8, 9, 10, and 11 **may be required** for types of industry not specified in Table 7 for specific parameters that are believed to be present in the wastewater.

Table 8 for Outfall No.: 001 Samples are (check one): ☐ Composite ☒ Grab

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)
Acrolein	<50				50
Acrylonitrile	<50				50
Benzene	<10				10
Bromoform	<10				10
Carbon tetrachloride	<2				2
Chlorobenzene	<10				10
Chlorodibromomethane	<10				10
Chloroethane	<50				50
2-Chloroethylvinyl ether	<10				10
Chloroform	<10				10
Dichlorobromomethane [Bromodichloromethane]	<10				10
1,1-Dichloroethane	<10				10
1,2-Dichloroethane	<10				10
1,1-Dichloroethylene [1,1-Dichloroethene]	<10				10
1,2-Dichloropropane	<10				10
1,3-Dichloropropylene [1,3-Dichloropropene]	<10				10
Ethylbenzene	<10				10
Methyl bromide [Bromomethane]	<50				50
Methyl chloride [Chloromethane]	<50				50
Methylene chloride [Dichloromethane]	<20				20
1,1,2,2-Tetrachloroethane	<10				10
Tetrachloroethylene [Tetrachloroethene]	<10				10
Toluene	<10				10
1,2-Trans-dichloroethylene [1,2-Trans-dichloroethene]	<10				10

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)
1,1,1-Trichloroethane	<10				10
1,1,2-Trichloroethane	<10				10
Trichloroethylene [Trichloroethene]	<10				10
Vinyl chloride	<10				10

* Indicate units if different from µg/L.

Table 9 for Outfall No.: **001** Samples are (check one): ☐ Composite ☒ Grab

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)
2-Chlorophenol	<10				10
2,4-Dichlorophenol	<10				10
2,4-Dimethylphenol	<10				10
4,6-Dinitro-o-cresol	<50				50
2,4-Dinitrophenol	<50				50
2-Nitrophenol	<20				20
4-Nitrophenol	<50				50
p-Chloro-m-cresol	<10				10
Pentachlorophenol	<5				5
Phenol	<10				10
2,4,6-Trichlorophenol	<10				10

* Indicate units if different from µg/L.

Table 10 for Outfall No.: **N/A** Samples are (check one): ☐ Composite ☐ Grab

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)
Acenaphthene	N/A	N/A	N/A	N/A	10
Acenaphthylene	N/A	N/A	N/A	N/A	10
Anthracene	N/A	N/A	N/A	N/A	10
Benzidine	N/A	N/A	N/A	N/A	50
Benzo(a)anthracene	N/A	N/A	N/A	N/A	5
Benzo(a)pyrene	N/A	N/A	N/A	N/A	5
3,4-Benzofluoranthene [Benzo(b)fluoranthene]	N/A	N/A	N/A	N/A	10
Benzo(ghi)perylene	N/A	N/A	N/A	N/A	20
Benzo(k)fluoranthene	N/A	N/A	N/A	N/A	5
Bis(2-chloroethoxy)methane	N/A	N/A	N/A	N/A	10

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)
Bis(2-chloroethyl)ether	N/A	N/A	N/A	N/A	10
Bis(2-chloroisopropyl)ether	N/A	N/A	N/A	N/A	10
Bis(2-ethylhexyl)phthalate	N/A	N/A	N/A	N/A	10
4-Bromophenyl phenyl ether	N/A	N/A	N/A	N/A	10
Butylbenzyl phthalate	N/A	N/A	N/A	N/A	10
2-Chloronaphthalene	N/A	N/A	N/A	N/A	10
4-Chlorophenyl phenyl ether	N/A	N/A	N/A	N/A	10
Chrysene	N/A	N/A	N/A	N/A	5
Dibenzo(a,h)anthracene	N/A	N/A	N/A	N/A	5
1,2-Dichlorobenzene [o-Dichlorobenzene]	N/A	N/A	N/A	N/A	10
1,3-Dichlorobenzene [m-Dichlorobenzene]	N/A	N/A	N/A	N/A	10
1,4-Dichlorobenzene [p-Dichlorobenzene]	N/A	N/A	N/A	N/A	10
3,3'-Dichlorobenzidine	N/A	N/A	N/A	N/A	5
Diethyl phthalate	N/A	N/A	N/A	N/A	10
Dimethyl phthalate	N/A	N/A	N/A	N/A	10
Di-n-butyl phthalate	N/A	N/A	N/A	N/A	10
2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	10
2,6-Dinitrotoluene	N/A	N/A	N/A	N/A	10
Di-n-octyl phthalate	N/A	N/A	N/A	N/A	10
1,2-Diphenylhydrazine (as Azobenzene)	N/A	N/A	N/A	N/A	20
Fluoranthene	N/A	N/A	N/A	N/A	10
Fluorene	N/A	N/A	N/A	N/A	10
Hexachlorobenzene	N/A	N/A	N/A	N/A	5
Hexachlorobutadiene	N/A	N/A	N/A	N/A	10
Hexachlorocyclopentadiene	N/A	N/A	N/A	N/A	10
Hexachloroethane	N/A	N/A	N/A	N/A	20
Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	N/A	5
Isophorone	N/A	N/A	N/A	N/A	10
Naphthalene	N/A	N/A	N/A	N/A	10
Nitrobenzene	N/A	N/A	N/A	N/A	10
N-Nitrosodimethylamine	N/A	N/A	N/A	N/A	50

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)
N-Nitrosodi-n-propylamine	N/A	N/A	N/A	N/A	20
N-Nitrosodiphenylamine	N/A	N/A	N/A	N/A	20
Phenanthrene	N/A	N/A	N/A	N/A	10
Pyrene	N/A	N/A	N/A	N/A	10
1,2,4-Trichlorobenzene	N/A	N/A	N/A	N/A	10

* Indicate units if different from µg/L.

Table 11 for Outfall No.: N/A Samples are (check one): ☐ Composite ☐ Grab

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)
Aldrin	N/A	N/A	N/A	N/A	0.01
alpha-BHC [alpha-Hexachlorocyclohexane]	N/A	N/A	N/A	N/A	0.05
beta-BHC [beta-Hexachlorocyclohexane]	N/A	N/A	N/A	N/A	0.05
gamma-BHC [gamma-Hexachlorocyclohexane]	N/A	N/A	N/A	N/A	0.05
delta-BHC [delta-Hexachlorocyclohexane]	N/A	N/A	N/A	N/A	0.05
Chlordane	N/A	N/A	N/A	N/A	0.2
4,4'-DDT	N/A	N/A	N/A	N/A	0.02
4,4'-DDE	N/A	N/A	N/A	N/A	0.1
4,4'-DDD	N/A	N/A	N/A	N/A	0.1
Dieldrin	N/A	N/A	N/A	N/A	0.02
Endosulfan I (alpha)	N/A	N/A	N/A	N/A	0.01
Endosulfan II (beta)	N/A	N/A	N/A	N/A	0.02
Endosulfan sulfate	N/A	N/A	N/A	N/A	0.1
Endrin	N/A	N/A	N/A	N/A	0.02
Endrin aldehyde	N/A	N/A	N/A	N/A	0.1
Heptachlor	N/A	N/A	N/A	N/A	0.01
Heptachlor epoxide	N/A	N/A	N/A	N/A	0.01
PCB 1242	N/A	N/A	N/A	N/A	0.2
PCB 1254	N/A	N/A	N/A	N/A	0.2
PCB 1221	N/A	N/A	N/A	N/A	0.2
PCB 1232	N/A	N/A	N/A	N/A	0.2
PCB 1248	N/A	N/A	N/A	N/A	0.2

Pollutant	Sample 1 (µg/L)*	Sample 2 (µg/L)*	Sample 3 (µg/L)*	Sample 4 (µg/L)*	MAL (µg/L)
PCB 1260	N/A	N/A	N/A	N/A	0.2
PCB 1016	N/A	N/A	N/A	N/A	0.2
Toxaphene	N/A	N/A	N/A	N/A	0.3

* Indicate units if different from µg/L.

Attachment: Click to enter text.

TABLE 12 (DIOXINS/FURAN COMPOUNDS)

Complete of Table 12 **is required** for **external outfalls**, as directed below. (Instructions, Pages 59-60)

Indicate which compound(s) are manufactured or used at the facility and provide a brief description of the conditions of its/their presence at the facility (check all that apply).

- ☐ 2,4,5-trichlorophenoxy acetic acid (2,4,5-T) CASRN 93-76-5
- ☐ 2-(2,4,5-trichlorophenoxy) propanoic acid (Silvex, 2,4,5-TP) CASRN 93-72-1
- ☐ 2-(2,4,5-trichlorophenoxy) ethyl 2,2-dichloropropionate (Erbon) CASRN 136-25-4
- ☐ 0,0-dimethyl 0-(2,4,5-trichlorophenyl) phosphorothioate (Ronnel) CASRN 299-84-3
- ☐ 2,4,5-trichlorophenol (TCP) CASRN 95-95-4
- ☐ hexachlorophene (HCP) CASRN 70-30-4
- ☒ None of the above

Description: N/A

Does the applicant or anyone at the facility know or have any reason to believe that 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) or any congeners of TCDD may be present in the effluent proposed for discharge?

☐ Yes ☒ No

Description: N/A

If **yes** to either Items a **or** b, complete Table 12 as instructed.

Table 12 for Outfall No.: N/A **Samples are (check one):** ☐ **Composite** ☐ **Grab**

Compound	Toxicity Equivalent Factors	Wastewater Concentration (ppq)	Wastewater Toxicity Equivalents (ppq)	Sludge Concentration (ppt)	Sludge Toxicity Equivalents (ppt)	MAL (ppq)
2,3,7,8-TCDD	1	N/A	N/A	N/A	N/A	10
1,2,3,7,8-PeCDD	1.0	N/A	N/A	N/A	N/A	50
2,3,7,8-HxCDDs	0.1	N/A	N/A	N/A	N/A	50
1,2,3,4,6,7,8-HpCDD	0.01	N/A	N/A	N/A	N/A	50

Compound	Toxicity Equivalent Factors	Wastewater Concentration (ppq)	Wastewater Toxicity Equivalents (ppq)	Sludge Concentration (ppt)	Sludge Toxicity Equivalents (ppt)	MAL (ppq)
2,3,7,8-TCDF	0.1	N/A	N/A	N/A	N/A	10
1,2,3,7,8-PeCDF	0.03	N/A	N/A	N/A	N/A	50
2,3,4,7,8-PeCDF	0.3	N/A	N/A	N/A	N/A	50
2,3,7,8-HxCDFs	0.1	N/A	N/A	N/A	N/A	50
2,3,4,7,8-HpCDFs	0.01	N/A	N/A	N/A	N/A	50
OCDD	0.0003	N/A	N/A	N/A	N/A	100
OCDF	0.0003	N/A	N/A	N/A	N/A	100
PCB 77	0.0001	N/A	N/A	N/A	N/A	500
PCB 81	0.0003	N/A	N/A	N/A	N/A	500
PCB 126	0.1	N/A	N/A	N/A	N/A	500
PCB 169	0.03	N/A	N/A	N/A	N/A	500
Total		N/A	N/A	N/A	N/A	

TABLE 13 (HAZARDOUS SUBSTANCES)

Complete Table 13 **is required** for all **external outfalls** as directed below. (Instructions, Pages 60-61)

Are there any pollutants listed in the instructions (pages 55-62) believed present in the discharge?

☐ Yes ☒ No

Are there pollutants listed in Item 1.c. of Technical Report 1.0 which are believed present in the discharge and have not been analytically quantified elsewhere in this application?

☐ Yes ☒ No

If **yes** to either Items a **or** b, complete Table 13 as instructed.

Table 13 for Outfall No.: N/A **Samples are (check one):** ☐ **Composite** ☐ **Grab**

Pollutant	CASRN	Sample 1 (µg/L)	Sample 2 (µg/L)	Sample 3 (µg/L)	Sample 4 (µg/L)	Analytical Method
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A

INDUSTRIAL WASTEWATER PERMIT APPLICATION WORKSHEET 4.0: RECEIVING WATERS

This worksheet **is required** for all TPDES permit applications.

Item 1. Domestic Drinking Water Supply (Instructions, Page 80)

a. There is a surface water intake for domestic drinking water supply located within 5 (five) miles downstream from the point/proposed point of discharge.

☒ Yes ☐ No

If **no**, stop here and proceed to Item 2. If **yes**, provide the following information:

1. The legal name of the owner of the drinking water supply intake: City of Dallas Water Supply

2. The distance and direction from the outfall to the drinking water supply intake: ~2.5 miles to the SE.

b. Locate and identify the intake on the USGS 7.5-minute topographic map provided for Administrative Report 1.0.

☒ Check this box to confirm the above requested information is provided.

Item 2. Discharge Into Tidally Influenced Waters (Instructions, Page 80)

If the discharge is to tidally influenced waters, complete this section. Otherwise, proceed to Item 3.

a. Width of the receiving water at the outfall: N/A feet

b. Are there oyster reefs in the vicinity of the discharge?

☐ Yes ☐ No

If **yes**, provide the distance and direction from the outfall(s) to the oyster reefs: N/A

c. Are there sea grasses within the vicinity of the point of discharge?

☐ Yes ☐ No

If **yes**, provide the distance and direction from the outfall(s) to the grasses: N/A

Item 3. Classified Segment (Instructions, Page 80)

The discharge is/will be directly into (or within 300 feet of) a classified segment.

☒ Yes ☐ No

If **yes**, stop here and do not complete Items 4 and 5 of this worksheet or Worksheet 4.1.

If **no**, complete Items 4 and 5 and Worksheet 4.1 may be required.

Item 4. Description of Immediate Receiving Waters (Instructions, Page 80)

a. Name of the immediate receiving waters: Click to enter text.

b. Check the appropriate description of the immediate receiving waters:

- ☐ Lake or Pond
  - Surface area (acres): Click to enter text.
  - Average depth of the entire water body (feet): Click to enter text.
  - Average depth of water body within a 500-foot radius of the discharge point (feet): Click to enter text.
- ☐ Man-Made Channel or Ditch
- ☐ Stream or Creek
- ☐ Freshwater Swamp or Marsh
- ☐ Tidal Stream, Bayou, or Marsh
- ☐ Open Bay
- ☐ Other, specify:

If **Man-Made Channel or Ditch** or **Stream or Creek** were selected above, provide responses to Items 4.c – 4.g below:

c. For **existing discharges,** check the description below that best characterizes the area **upstream** of the discharge.

For **new discharges,** check the description below that best characterizes the area **downstream** of the discharge.

- ☐ Intermittent (dry for at least one week during most years)
- ☐ Intermittent with Perennial Pools (enduring pools containing habitat to maintain aquatic life uses)
- ☐ Perennial (normally flowing)

Check the source(s) of the information used to characterize the area upstream (existing discharge) or downstream (new discharge):

- ☐ USGS flow records
- ☐ personal observation
- ☐ historical observation by adjacent landowner(s)
- ☐ other, specify: Click to enter text.

d. List the names of all perennial streams that join the receiving water within three miles downstream of the discharge point: Click to enter text.

e. The receiving water characteristics change within three miles downstream of the discharge (e.g., natural or man-made dams, ponds, reservoirs, etc.).

☐ Yes ☐ No

If **yes**, describe how: Click to enter text.

f. General observations of the water body during normal dry weather conditions: Click to enter text.

Date and time of observation: Click to enter text.

g. The water body was influenced by stormwater runoff during observations.

☐ Yes ☒ No

If **yes**, describe how: Click to enter text.

Item 5. General Characteristics of Water Body (Instructions, Page 81)

a. Is the receiving water upstream of the existing discharge or proposed discharge site influenced by any of the following (check all that apply):

- ☐ oil field activities
- ☐ agricultural runoff
- ☐ upstream discharges
- ☐ urban runoff
- ☐ septic tanks
- ☐ other, specify: Click to enter text.

b. Uses of water body observed or evidence of such uses (check all that apply):

- ☐ livestock watering
- ☐ non-contact recreation
- ☐ domestic water supply
- ☐ contact recreation
- ☐ fishing
- ☐ industrial water supply
- ☐ irrigation withdrawal
- ☐ navigation
- ☐ picnic/park activities
- ☐ other, specify: Click to enter text.

c. Description which best describes the aesthetics of the receiving water and the surrounding area (check only one):

- ☐ **Wilderness:** outstanding natural beauty; usually wooded or un-pastured area: water clarity exceptional
- ☐ **Natural Area:** trees or native vegetation common; some development evident (from fields, pastures, dwellings); water clarity discolored
- ☐ **Common Setting:** not offensive, developed but uncluttered; water may be colored or turbid
- ☐ **Offensive:** stream does not enhance aesthetics; cluttered; highly developed; dumping areas; water discolored

INDUSTRIAL WASTEWATER PERMIT APPLICATION WORKSHEET 11.0: COOLING WATER SYSTEM INFORMATION

This worksheet **is required** for all TPDES permit applications **that meet the conditions outlined in Technical Report 1.0, Item 12.**

Item 1. Cooling Water System Data (Instructions, Page 104)

a. Complete the following table with information regarding the cooling water system.

Cooling Water System Data

Parameter	Volume (include units)
Total DIF	870 MGD
Total AIF	120 MGD
Intake Flow Use(s) (%)	
Contact cooling	0
Non-contact cooling	>99
Process Wastewater	<1
Other	<1

b. Attach the following information:

1. A narrative description of the design and annual operation of the facility's cooling water system and its relationship to the CWIS(s).

2. A scaled map depicting the location of each CWIS, impoundment, intake pipe, and canals, pipes, or waterways used to convey cooling water to, or within, the cooling water system. Provide the latitude and longitude for each CWIS and any intake pipe(s) on the map. Indicate the position of the intake pipe within the water column.

3. A description of water reuse activities, if applicable, reductions in total water withdrawals, if applicable, and the proportion of the source waterbody withdrawn (on a monthly basis).

4. Design and engineering calculations prepared by a qualified professional and data to support the information provided in above item a.

5. Previous year (a minimum of 12 months) of AIF data.

6. A narrative description of existing or proposed impingement and entrainment technologies or operation measures and a summary of their performance, including, but not limited to, reductions in impingement mortality and entrainment due to intake location and reductions in total water withdrawals and usage.

Attachment: L: Lake Hubbard Steam Electric Station & 316(b) Information and M: Design and Engineering Calculations of CWIS

Item 2. Cooling Water Intake Structure(s) Data (Instructions, Page 105)

a. Complete the following table with information regarding each cooling water intake structure (this includes primary and make-up CWIS(s)).

Cooling Water Intake Structure(s) Data

CWIS ID	LH CWIS #1			
DIF (include units)	870 MGD			
AIF (include units)	120 MGD			
Intake Flow Use(s) (%)				
Contact cooling	0			
Non-contact cooling	>99			
Process Wastewater	<1			
Other	<1			
Latitude (decimal degrees)	32.835746			
Longitude (decimal degrees)	-96.544863			

b. Attach the following information regarding the CWIS(s):

1. A narrative description of the configuration of each CWIS, annual and daily operation, including any seasonal changes, and where it is located in the water body and in the water column.

2. Engineering calculations for each CWIS.

Attachment: L: Lake Hubbard Steam Electric Station & 316(b) Information and M: Design and Engineering Calculations of CWIS

Item 3. Source Water Physical Data (Instructions, Page 105)

a. Complete the following table with information regarding the CWIS(s) source waterbody (this includes primary and make-up CWIS(s)).

Source Waterbody Data

CWIS ID	LH CWIS #1			
Source Waterbody	Lake Ray Hubbard Res.			
Mean Annual Flow	N/A			
Source	Trinity River			

b. Attach the following information regarding the source waterbody.

1. A narrative description of the source water for each CWIS, including areal dimensions, depths, salinity and temperature regimes, and other documentation that supports this

determination of the water body type where each cooling water intake structure is located.

2. A narrative description of the source waterbody's hydrological and geomorphological features.

3. Scaled drawings showing the physical configuration of all source water bodies used by the facility, including the source waterbody's hydrological and geomorphological features. **NOTE:** The source waterbody's hydrological and geomorphological features may be included on the map submitted for item 1.b.ii of this worksheet.

4. A description of the methods used to conduct any physical studies to determine the intake's area of influence within the waterbody and the results of such studies.

Attachment: L: Lake Hubbard Steam Electric Station & 316(b) Information and M: Design and Engineering Calculations of CWIS

Item 4. Operational Status (Instructions, Page 106)

a. Is this application for a power production or steam generation facility?

☒ Yes ☐ No

If **no**, proceed to Item 4.b. If **yes**, provide the following information as an attachment:

1. Describe the operating status of each individual unit, including age, capacity utilization rate (or equivalent) for the previous five years (a minimum of 60 months), and any seasonal changes in operation.

2. Describe any extended or unusual outages or other factors which significantly affect current data for flow, impingement, entrainment.

3. Identify any operating unit with a capacity utilization rate of less than 8 percent averaged over a contiguous period of two years (a minimum of 24 months).

4. Describe any major upgrades completed within the last 15 years, including but not limited to boiler replacement, condenser replacement, turbine replacement, or changes of fuel type.

Attachment: L: Lake Hubbard Steam Electric Station & 316(b) Information and M: Design and Engineering Calculations of CWIS

b. Process Units

1. Is this application for a facility which has process units that use cooling water (other than for power production or steam generation)?

☐ Yes ☒ No

If **no**, proceed to Item 4.c. If **yes**, continue.

2. Does the facility use or intend to use reductions in flow or changes in operations to meet the requirements of *40 CFR § 125.94(c)*?

☐ Yes ☐ No

If **no**, proceed to Item 4.c. If **yes**, attach descriptions of the following information:

- Individual production processes and product lines
- The operating status, including age of each line and seasonal operation
- Any extended or unusual outages that significantly affect current data for flow, impingement, entrainment, or other factors
- Any major upgrades completed within the last 15 years and plans or schedules for decommissioning or replacement of process units or production processes and product lines.

Attachment: Click to enter text.

c. Is this an application for a nuclear power production facility?

☐ Yes ☒ No

If **no**, proceed to Item 4.d. If **yes**, attach a description of completed, approved, or scheduled upgrades and the Nuclear Regulatory Commission relicensing status for each unit at the facility.

Attachment: Click to enter text.

d. Is this an application for a manufacturing facility?

☐ Yes ☒ No

If **no**, proceed to Worksheet 11.1. If **yes**, attach descriptions of current and future production schedules and any plans or schedules for any new units planned within the next five years (a minimum of 60 mos)

Attachment: Click to enter text.

INDUSTRIAL WASTEWATER PERMIT APPLICATION WORKSHEET 11.1: IMPINGEMENT MORTALITY

This worksheet **is required** for all TPDES permit applications **that meet the conditions outlined in Technical Report 1.0, Item 12.** Complete one copy of this worksheet for **each** individual CWIS the facility uses or proposes to use.

CWIS ID: LH CWIS #1

Item 1. Impingement Compliance Technology Selection (Instructions, Page 107)

Check the box next to the method of compliance for the Impingement Mortality Standard selected by the facility.

- ☒ Closed-cycle recirculating system(CCRS) [*40 CFR § 125.94(c)(1)*]
- ☐ 0.5 ft/s Through-Screen Design Velocity [*40 CFR § 125.94(c)(2)*] - Proceed to Worksheet 11.2
- ☐ 0.5 ft/s Through Screen Actual Velocity [*40 CFR § 125.94(c)(3)*]
- ☐ Existing offshore velocity cap [*40 CFR § 125.94(c)(4)*] - Proceed to Worksheet 11.2
- ☐ Modified traveling screens [*40 CFR § 125.94(c)(5)*]
- ☐ System of technologies [*40 CFR § 125.94(c)(6)*]
- ☐ Impingement mortality performance standard [*40 CFR § 125.94(c)(7)*]
- ☐ De minimis rate of impingement [*40 CFR § 125.94(c)(11)*]
- ☐ Low capacity utilization power-generation facilities [*40 CFR § 125.94(c)(12)*]

If 0.5 ft/s Through-Screen Design Velocity [*40 CFR § 125.94(c)(2)*] or existing offshore velocity cap [*40 CFR § 125.94(c)(4)*] was selected, proceed to Worksheet 11.2. Otherwise, continue to Item 2.

Item 2. Impingement Compliance Technology Information (Instructions, Page 107)

Complete the following sections based on the selection made for item 1 above.

a. CCRS [*40 CFR § 125.94(c)(1)*]

☒ Check this box to confirm the CWS meets the definition of CCRS located at *40 CFR § 125.91(c)* and provide a response to the following questions.

1. Does the facility use or propose to use a CWIS to replenish water losses to the CWS?

☐ Yes ☒ No

If **no**, proceed to item a.2. If **yes**, provide the following information as an attachment and continue.

- CWIS ID
- 12 months of intake flow data for any CWIS used for make-up intake flows to replenish cooling water losses, excluding intakes for losses due to blowdown, drift, or evaporation.

- A narrative description of any physical or operational measures taken to minimize make-up withdraws.

Attachment: Click to enter text.

NOTE: Do not complete a separate Worksheet 11.1 for a make-up CWIS.

2. Does the facility use or propose to use cooling towers?

☐ Yes ☒ No

If **no**, proceed to Worksheet 11.2. If **yes**, provide the following information and proceed to Worksheet 11.2.

- Average number of cycles of concentration (COCs) prior to blowdown:

Average COCs Prior to Blowdown

Cooling Tower ID				
COCs				

- Attach COC monitoring data for each cooling tower from the previous year (a minimum of 12 months): Click to enter text.
- Maximum number of COCs each cooling tower can accomplish based on design of the system.

Calculated COCs Prior to Blowdown

Cooling Tower ID				
COCs				

- Describe conditions that may limit the number of COCs prior to blowdown, if any, including but not limited to permit conditions: Click to enter text.

b. 0.5 ft/s Through Screen Actual Velocity [*40 CFR § 125.94(c)(3)*]

Provide daily intake flow measurement monitoring data from the previous year (a minimum of 12 months) as an attachment and proceed to Worksheet 11.2.

Attachment: Click to enter text.

c. Modified traveling screens [*40 CFR § 125.94(c)(5)*]

Provide the following information as an attachment and proceed to Worksheet 11.2.

1. A description of the modified traveling screens and associated equipment.
2. A site-specific impingement technology performance optimization study that includes a narrative description of the biological data collection methods
3. Biological sampling data from the previous two years (a minimum of 24 months).

Attachment: Click to enter text.

d. System of technologies [*40 CFR § 125.94(c)(6)*] or impingement mortality performance standard [*40 CFR § 125.94(c)(7)*]

Provide the following information as an attachment and proceed to Worksheet 11.2.

1. A description of the system of technologies used or proposed for use by the facility to

achieve compliance with the impingement mortality standard.

2. A site-specific impingement technology performance optimization study that includes a narrative description of the biological data collection methods.

3. Biological sampling data from the previous two years (a minimum of 24 months).

Attachment: Click to enter text.

e. De minimis rate of impingement [*40 CFR § 125.94(c)(11)*]

Provide the following information and proceed to Worksheet 11.2.

1. Attach monitoring data from the previous year (a minimum of 12 months) of intake flow measured at a frequency of 1/day on days of operation.

Attachment: Click to enter text.

2. If the rate of impingement caused by the CWIS is extremely low (at an organism or age-one equivalent count), attach supplemental information to Worksheet 11.0, item 1.b.6. to support this determination.

Attachment: Click to enter text.

f. Low capacity utilization power-generation facilities [*40 CFR § 125.94(c)(12)*]

Attach monthly utilization data from the previous 2 years (a minimum of 24 months) for each operating unit and proceed to Worksheet 11.2.

Attachment: Click to enter text.

INDUSTRIAL WASTEWATER PERMIT APPLICATION WORKSHEET 11.2: SOURCE WATER BIOLOGICAL DATA

This worksheet **is required** for all TPDES permit applications that **meet the conditions outlined in Technical Report 1.0, Item 12.** Complete one copy of this worksheet for **each** source waterbody of a CWIS for which a facility has selected an Impingement Mortality Technology Option described at *40 CFR §§ 125.94(c)(1)-(7).*

Name of source waterbody: Lake Ray Hubbard Reservoir

Item 1. Species Management (Instructions, Page 109)

a. The facility has obtained an incidental take permit for its cooling water intake structure(s) from the USFWS or the NMFS.

☐ Yes ☒ No

If yes, attach any information submitted in order to obtain that permit, which may be used to supplement the permit application information requirements of paragraph *40 CFR § 125.95(f).*

Attachment: Click to enter text.

b. Is the facility requesting a waiver from application requirements at *40 CFR § 122.21(r)(4)* in accordance with *40 CFR § 125.95* for any CWIS(s) that withdraw from a man-made reservoir that is stocked and managed by a state or federal natural resources agency or the equivalent?

☒ Yes ☐ No

If **yes**, attach a copy of the most recent managed fisheries report to TPWD, or equivalent.

Attachment: N: Supplemental Fisheries Data Analysis for Proposal for Information Collection, Clean Water Act, Section 316(b) Phase II Requirements

c. There are no federally listed threatened or endangered species or critical habitat designations within the source water body.

☒ True ☐ False

Item 2. Source Water Biological Data (Instructions, Page 109)

New Facilities (Phase I, Track I and II)

- Provide responses to all items in this section and stop.

Existing Facilities (Phase II)

- If the answer to **1.b.** above was **no**, provide responses to all items in this section and proceed to Worksheet 11.3.
- If the answer to **1.b.** was **yes** and **1.c.** was **true**, do not complete any items in this section and proceed to Worksheet 11.3.
- If the answer to **1.b.** was **yes** and **1.c.** was **false**, attach a response for any item in this section that is not contained within the most recent TPWD, or equivalent and proceed to Worksheet 11.3.

Attachment: Click to enter text.

a. A list of the data requested at *40 CFR § 122.21(r)(4)(ii)* through *(vi)* that are not available, and efforts made to identify sources of the data.

b. Provide a list of species (or relevant taxa) in the vicinity of the CWIS and identify the following information regarding each species listed.
   - all life stages and their relative abundance,
   - identification of all species and life stages that would be most susceptible to impingement and entrainment,
   - forage base,
   - significance to commercial fisheries,
   - significance to recreational fisheries,
   - primary period of reproduction,
   - larval recruitment, and
   - period of peak abundance for relevant taxa.

c. Data representative of the seasonal and daily activities (e.g., feeding and water column migration) of biological organisms in the vicinity of the CWIS(s).

d. Identify all threatened, endangered, and other protected species that might be susceptible to impingement and entrainment at the CWIS(s).

e. Documentation of any public participation or consultation with federal or state agencies undertaken.

The following is required for existing facilities only. Include the following information with the above listed attachment.

f. Identify any protective measures and stabilization activities that have been implemented and provide a description of how these measures and activities affected the baseline water condition in the vicinity of the intake.

g. A list of fragile species, as defined at *40 CFR § 125.92(m)*, at the facility. The applicant need only identify those species not already identified as fragile at *40 CFR § 125.92(m)*.

NOTE: New units at an existing facility are not required to resubmit this information if the cooling water withdrawals for the operation of the new unit are from an existing intake.

INDUSTRIAL WASTEWATER PERMIT APPLICATION WORKSHEET 11.3: ENTRAINMENT

This worksheet **is required** for all TPDES permit applications that **meet the conditions outlined in Technical Report 1.0, Item 12.** Complete one copy of this worksheet for **each** individual CWIS the facility uses or proposes to use.

CWIS ID: LH CWIS #1

Item 1. Applicability (Instructions, Page 111)

Is the AIF of the CWIS identified above greater than, or equal to, 125 MGD?

☐ Yes ☒ No

- If **no** or the facility has selected **CCRS** [*40 CFR § 125.94(c)(1)*] for the impingement mortality compliance method, complete Item 2 and stop here.
- If **yes** and the facility is **seeking a waiver** from application requirements in accordance with *40 CFR § 125.95* for any CWIS(s) that withdraw from a man-made reservoir that is stocked and managed by a state or federal natural resources agency or the equivalent, complete item 2 and stop.
- If **yes** and the facility is **not seeking a waiver** from application requirements in accordance *with 40 CFR § 125.95*, complete item 2 and provide any required and completed studies listed in item 3. For any required studies in item 3 that are not complete, provide a detailed explanation for the delay and an anticipated schedule for completion and submittal.

Item 2. Existing Entrainment Performance Studies (Instructions, Page 111)

Attach any previously conducted studies or studies obtained from other facilities addressing technology efficacy, through-facility entrainment survival, and other entrainment studies.

Attachment: N: Supplemental Fisheries Data Analysis for Proposal for Information Collection, Clean Water Act, Section 316(b) Phase II Requirements

Item 3. Facility Entrainment Performance Studies (Instructions, Page 111)

a. Attach an entrainment characterization study, as described at *40 CFR § 122.21(r)(9)*: Click to enter text.

b. Attach a comprehensive feasibility study, as described as *40 CFR § 122.21(r)(10)*: Click to enter text.

c. Attach a benefits valuation study, as described as *40 CFR § 122.21(r)(11)*: Click to enter text.

d. Attach a non-water quality environmental and other impacts study, as described as *40 CFR § 122.21(r)(12)*: Click to enter text.

e. Attach a peer review analysis, as described as *40 CFR § 122.21(r)(13)*: Click to enter text.

Attachment A

Copy of Renewal Application Fee Payment

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Your transaction is complete. Thank you for using TCEQ ePay.

Note: It may take up to 3 working days for this electronic payment to be processed and be reflected in the TCEQ ePay system. Print this receipt and the vouchers for your records. An email receipt has also been sent.

Transaction Information

Trace Number:	582EA000622336
Date:	08/20/2024 12:52 PM
Payment Method:	CC - Authorization 0000075645
ePay Actor:	RYAN BAYLE
Actor Email:	ryan.bayle@luminant.com
IP:	170.85.101.22
TCEQ Amount:	$2,015.00
Texas.gov Price:	$2,060.59*

* This service is provided by Texas.gov, the official website of Texas. The price of this service includes funds that support the ongoing operations and enhancements of Texas.gov, which is provided by a third party in partnership with the State.

Payment Contact Information

Name:	RYAN BAYLE
Company:	LUMINANT GENERATION COMPANY LLC
Address:	6555 SIERRA DRIVE, IRVING, TX 75039
Phone:	214-875-8294

Cart Items

Click on the voucher number to see the voucher details.

Voucher	Fee Description	AR Number	Amount
718057	WW PERMIT - MAJOR INDUSTRIAL FACILITY - RENEWAL		$2,000.00
718058	30 TAC 305.53B WQ RENEWAL NOTIFICATION FEE		$15.00
		TCEQ Amount:	$2,015.00

ePay Again | Exit ePay

Note: It may take up to 3 working days for this electronic payment to be processed and be reflected in the TCEQ ePay system. Print this receipt for your records.

Attachment B

Core Data Form

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

TCEQ Use Only

TCEQ Core Data Form

For detailed instructions on completing this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission *(If other is checked please describe in space provided.)*

☐ New Permit, Registration or Authorization *(Core Data Form should be submitted with the program application.)*

☒ Renewal *(Core Data Form should be submitted with the renewal form)* ☐ Other

2. Customer Reference Number *(if issued)*	Follow this link to search for CN or RN numbers in Central Registry**	3. Regulated Entity Reference Number *(if issued)*
CN 603256413		RN 100673490

SECTION II: Customer Information

4. General Customer Information | **5. Effective Date for Customer Information Updates** (mm/dd/yyyy)

☐ New Customer ☐ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)

The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).

6. Customer Legal Name *(If an individual, print last name first: eg: Doe, John)* | *If new Customer, enter previous Customer below:*

Luminant Generation Company LLC

7. TX SOS/CPA Filing Number	8. TX State Tax ID (11 digits)	9. Federal Tax ID (9 digits)	10. DUNS Number *(if applicable)*
800881216	17529678207	752967820	102247793

11. Type of Customer: ☒ Corporation ☐ Individual Partnership: ☐ General ☐ Limited
Government: ☐ City ☐ County ☐ Federal ☐ Local ☐ State ☐ Other ☐ Sole Proprietorship ☐ Other:

12. Number of Employees
☐ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☒ 501 and higher

13. Independently Owned and Operated?
☐ Yes ☒ No

14. Customer Role (Proposed or Actual) – *as it relates to the Regulated Entity listed on this form. Please check one of the following*

☐ Owner ☐ Operator ☒ Owner & Operator ☐ Other:
☐ Occupational Licensee ☐ Responsible Party ☐ VCP/BSA Applicant

15. Mailing Address: 6555 Sierra Drive

City	Irving	State	TX	ZIP	75039	ZIP + 4	

16. Country Mailing Information *(if outside USA)*	17. E-Mail Address *(if applicable)*
	Renee.collins@luminant.com

18. Telephone Number	19. Extension or Code	20. Fax Number *(if applicable)*

(214) 875-8654		( ) -

SECTION III: Regulated Entity Information

21. General Regulated Entity Information *(If 'New Regulated Entity" is selected, a new permit application is also required.)*

☐ New Regulated Entity ☐ Update to Regulated Entity Name ☐ Update to Regulated Entity Information

The Regulated Entity Name submitted may be updated, in order to meet TCEQ Core Data Standards (removal of organizational endings such as Inc, LP, or LLC).

22. Regulated Entity Name *(Enter name of the site where the regulated action is taking place.)*

Lake Hubbard Steam Electric Station

23. Street Address of the Regulated Entity: *(No PO Boxes)*	555 Barnes Bridge Road							
	City	Sunnyvale	**State**	TX	**ZIP**	75182	**ZIP + 4**	
24. County								

If no Street Address is provided, fields 25-28 are required.

25. Description to Physical Location:					
26. Nearest City			**State**		**Nearest ZIP Code**
Sunnyvale ,			TX		75182

Latitude/Longitude are required and may be added/updated to meet TCEQ Core Data Standards. (Geocoding of the Physical Address may be used to supply coordinates where none have been provided or to gain accuracy).

27. Latitude (N) In Decimal:	32.836337		**28. Longitude (W) In Decimal:**	-96.546470	
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

29. Primary SIC Code (4 digits)	**30. Secondary SIC Code** (4 digits)	**31. Primary NAICS Code** (5 or 6 digits)	**32. Secondary NAICS Code** (5 or 6 digits)
4911		221112	

33. What is the Primary Business of this entity? *(Do not repeat the SIC or NAICS description.)*

Generation of Electricity

34. Mailing Address:	6555 Sierra Drive							
	City	Irving	**State**	TX	**ZIP**	75039	**ZIP + 4**	
35. E-Mail Address:								

36. Telephone Number	**37. Extension or Code**	**38. Fax Number** *(if applicable)*
( ) -		( ) -

39. TCEQ Programs and ID Numbers Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

☐ Dam Safety	☐ Districts	☐ Edwards Aquifer	☐ Emissions Inventory Air	☐ Industrial Hazardous Waste
☐ Municipal Solid Waste	☐ New Source Review Air	☐ OSSF	☐ Petroleum Storage Tank	☐ PWS
☐ Sludge	☐ Storm Water	☐ Title V Air	☐ Tires	☐ Used Oil
☐ Voluntary Cleanup	☒ Wastewater	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:
	WQ0001245000 TX0001023			

SECTION IV: Preparer Information

40. Name:	Ryan Bayle	41. Title:	Environmental Manager

42. Telephone Number	43. Ext./Code	44. Fax Number	45. E-Mail Address
(214) 875-8294		( ) -	ryan.bayle@lumiannt.com

SECTION V: Authorized Signature

46. By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

Company:	Luminant Generation Company LLC	Job Title:	Sr. Director Environmental Services
Name *(in Print)*:	Renee Collins	Phone:	(214) 875- 8654
Signature:	Renee Collins	Date:	8/22/2024

Attachment C

Plain Language Summary

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Lake Hubbard Steam Electric Station
WQ0001245000
PLAIN LANGUAGE SUMMARY

The following summary is provided for this pending water quality permit application being reviewed by the Texas Commission on Environmental Quality as required by 30 Texas Administrative Code Chapter 39. The information provided in this summary may change during the technical review of the application and are not federal enforceable representations of the permit application.

Luminant Generation Company LLC (CN603256413) operates the Lake Hubbard Steam Electric Station (RN100673490), located at 555 Barnes Bridge Road, Sunnyvale, Dallas County, Texas 75182. The facility currently consists of two natural gas-fired steam electric generating units.

This application is for the renewal of Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0001245000 (EPA I.D. No. TX001023) which authorizes the discharge of wastewaters (once-through cooling and auxiliary cooling water) and previously monitored effluent (floor/equipment drains, equipment blowdown, water treatment wastes, low volume waste, metal cleaning waste and storm water) at a daily average flow not to exceed 870 million gallons per day via Outfall 001.

The discharge of once-through cooling water via Outfall 001 and previously monitored effluent via Outfall 101 from this facility is subject to federal effluent limitation guidelines at 40 CFR Part 423. The pollutants expected from these discharges based on 40 CFR Part 423 are: total residual chlorine, free available chlorine, total suspended solids, oil and grease, total iron, total copper and pH. Temperature is also expected from discharges of 001.

The raw water supply for the facility's cooling water and service water systems is from Lake Ray Hubbard Reservoir, supplied by the City of Dallas. A chemical feed system supplies water conditioning chemicals to the once-through cooling water to minimize corrosion and control the formation of mineral scale and bio-fouling. Domestic wastes are routed to the Duck Creek Wastewater Treatment Plant.

Estación eléctrica de vapor del lago Hubbard
WQ0001245000
RESUMEN EN LENGUAJE SENCILLO

El siguiente resumen se proporciona para esta solicitud de permiso de calidad del agua pendiente que está siendo revisada por la Comisión de Calidad Ambiental de Texas según lo exige el Capítulo 39 del Código Administrativo de Texas 30. La información proporcionada en este resumen puede cambiar durante la revisión técnica de la solicitud y no es federal. representaciones ejecutables de la solicitud de permiso.

Luminant Generation Company LLC (CN603256413) opera la estación eléctrica de vapor Lake Hubbard (RN100673490), ubicada en 555 Barnes Bridge Road, Sunnyvale, condado de Dallas, Texas 75182. La instalación actualmente consta de dos unidades generadoras de electricidad a vapor alimentadas con gas natural.

Esta solicitud es para la renovación del permiso No. WQ0001245000 del Sistema de Eliminación de Descarga de Contaminantes de Texas (TPDES) (EPA I.D. No. TX001023) que autoriza la descarga de aguas residuales (agua de enfriamiento de un solo paso y agua de enfriamiento auxiliar) y efluentes previamente monitoreados (piso/equipo). drenajes, purga de equipos, desechos de tratamiento de agua, desechos de bajo volumen, desechos de limpieza de metales y aguas pluviales) a un flujo promedio diario que no exceda los 870 millones de galones por día a través del Emisario 001.

La descarga de agua de enfriamiento de un solo paso a través del Emisario 001 y el efluente previamente monitoreado a través del Emisario 101 de esta instalación está sujeta a pautas federales de limitación de efluentes en 40 CFR Parte 423. Los contaminantes esperados de estas descargas con base en 40 CFR Parte 423 son: total residual cloro, cloro libre disponible, sólidos suspendidos totales, aceites y grasas, hierro total, cobre total y pH. También se espera temperatura por descargas de 001.

El suministro de agua cruda para los sistemas de agua de refrigeración y agua de servicio de la instalación proviene del embalse Lake Ray Hubbard, suministrado por la ciudad de Dallas. Un sistema de alimentación de químicos suministra químicos acondicionadores de agua al agua de enfriamiento de un solo paso para minimizar la corrosión y controlar la formación de incrustaciones minerales y bioincrustaciones. Los desechos domésticos se envían a la planta de tratamiento de aguas residuales de Duck Creek.

Attachment D

USGS TOPO MAPS

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

APPROXIMATE APPLICANT PROPERTY BOUNDARY

OUTFALL 001

OUTFALL 101

1 Mile Radius

APPROXIMATE TREATMENT FACILITY BOUNDARY

CITY OF DALLAS WATER SUPPLY INTAKE

ROCKWALL CO
KAUFMAN CO

Rose Hill

Corder Lake

HEATH

Lyons Cem

Pleasant Ridge Cem

Duck Cr

Lupton Lake

FREEPORT DR
KELSO LN
SIGNAL BAY DR
OAKS TRL
I-30 SVC RD
ROWLETT RD
SAVOY PL
ROBIN RD
SADDLEBACK RD
SUNDOWN LN
BROADWAY CMNS
GREENBELT PKWY
HILLSIDE LN
FRONTAGE RD
W I- 30
ASHGLEN DR
BRANCH OAKS DR
CLOVER VALLEY DR
DOVE MEADOW DR
EMBERWOOD DR
HEATHERBROOK DR
RUSTIC GLEN DR
RIDGECOVE DR
CRYSTAL LN
SASAKI WAY
BOBTOWN RD
LYONS RD
BROADWAY BLVD
FALLBROOK DR
MCCARTNEY LN
ALTA OAKS DR
CEDAR ELM LN
GUTHRIE RD
CHRISTINA LN
BARNES BRIDGE RD
TERRY I
PENINSULA CT
LEMLEY DR
VIA VENTURA
VIA AVENIDA
VIA SEVILLA
BELT LINE RD
O HARE DR
WOODBLUFF DR
VIA DEL SUR
VIA ALTOS
VIA SONOMA
HARDWOOD TRL
GREEN CANYON DR
VIA DEL NORTE
N BELT LINE RD
TOWN E BLVD
NEW HOPE RD
HIDDEN LAKE
STONE
EAGLES CREST DR
HOBSON RD
COLLINS RD
POLLY RD
E FORK RD
GLORIA RD
STONEY CREEK BLVD
ROCKSHIRE
DUCK CREEK WAY

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

MN
GN
3° 22′ 60 MILS
1° 19′ 23 MILS

ND 2016 MAGNETIC NORTH
ON AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
QB
Grid Zone Designation

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

MESQUITE, TX
2016

TEXAS
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Garland
2 Rowlett
3 Rockwall
4 White Rock Lake
5 Forney North
6 Hutchins
7 Seagoville

Attachment E

Supplemental Permit Information Form

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

SUPPLEMENTAL PERMIT INFORMATION FORM (SPIF)

FOR AGENCIES REVIEWING DOMESTIC OR INDUSTRIAL TPDES WASTEWATER PERMIT APPLICATIONS

TCEQ USE ONLY:

Application type: ____Renewal ____Major Amendment ____Minor Amendment ____New

County: _____ Segment Number: _____

Admin Complete Date: _____

Agency Receiving SPIF:

_____ Texas Historical Commission _____ U.S. Fish and Wildlife

_____ Texas Parks and Wildlife Department _____ U.S. Army Corps of Engineers

This form applies to TPDES permit applications only. (Instructions, Page 53)

Complete this form as a separate document. TCEQ will mail a copy to each agency as required by our agreement with EPA. If any of the items are not completely addressed or further information is needed, we will contact you to provide the information before issuing the permit. Address each item completely.

Do not refer to your response to any item in the permit application form. Provide each attachment for this form separately from the Administrative Report of the application. The application will not be declared administratively complete without this SPIF form being completed in its entirety including all attachments. Questions or comments concerning this form may be directed to the Water Quality Division's Application Review and Processing Team by email at WQ-ARPTeam@tceq.texas.gov or by phone at (512) 239-4671.

The following applies to all applications:

1. Permittee: Luminant Generation Company LLC

   Permit No. WQ00 01245000 EPA ID No. TX 0001023

   Address of the project (or a location description that includes street/highway, city/vicinity, and county):

   555 Barnes Bridge Road, Sunnyvale, TX 75182

Provide the name, address, phone and fax number of an individual that can be contacted to answer specific questions about the property.

Prefix (Mr., Ms., Miss):

First and Last Name: Ryan Bayle

Credential (P.E, P.G., Ph.D., etc.): P.G

Title: Environmental Manager

Mailing Address: 6555 Sierra Drive

City, State, Zip Code: Irving, TX, 75039

Phone No.: 214-875-8294 Ext.: Fax No.:

E-mail Address: ryan.bayle@luminant.com

2. List the county in which the facility is located: Hood
3. If the property is publicly owned and the owner is different than the permittee/applicant, please list the owner of the property.

N/A

4. Provide a description of the effluent discharge route. The discharge route must follow the flow of effluent from the point of discharge to the nearest major watercourse (from the point of discharge to a classified segment as defined in 30 TAC Chapter 307). If known, please identify the classified segment number.

Via Outfall 001 directly to Lake Ray Hubbard in Segment No. 0820 of the Trinity River Basin

5. Please provide a separate 7.5-minute USGS quadrangle map with the project boundaries plotted and a general location map showing the project area. Please highlight the discharge route from the point of discharge for a distance of one mile downstream. (This map is required in addition to the map in the administrative report).

Provide original photographs of any structures 50 years or older on the property.

Does your project involve any of the following? Check all that apply.

- ☐ Proposed access roads, utility lines, construction easements
- ☐ Visual effects that could damage or detract from a historic property's integrity
- ☐ Vibration effects during construction or as a result of project design
- ☐ Additional phases of development that are planned for the future
- ☐ Sealing caves, fractures, sinkholes, other karst features

☐ Disturbance of vegetation or wetlands

1. List proposed construction impact (surface acres to be impacted, depth of excavation, sealing of caves, or other karst features):

N/A

2. Describe existing disturbances, vegetation, and land use:

Power Plant associated structures, facilities and roads.

THE FOLLOWING ITEMS APPLY ONLY TO APPLICATIONS FOR NEW TPDES PERMITS AND MAJOR AMENDMENTS TO TPDES PERMITS

3. List construction dates of all buildings and structures on the property:

N/A

4. Provide a brief history of the property, and name of the architect/builder, if known.

N/A

APPROXIMATE APPLICANT PROPERTY BOUNDARY

OUTFALL 001

OUTFALL 101

1 Mile Radius

APPROXIMATE TREATMENT FACILITY BOUNDARY

CITY OF DALLAS WATER SUPPLY INTAKE

Rose Hill

Lyons Cem

Pleasant Ridge Cem

Corder Lake

Duck Cr

Lupton Lake

HEATH

ROCKWALL CO

KAUFMAN CO

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2

1000 500 0 METERS 1000 2000

1 0.5 0 1

MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

FEET

3° 22′ 60 MILS

1° 19′ 23 MILS

GN

MN

ND 2016 MAGNETIC NORTH
ON AT CENTER OF SHEET

TEXAS

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Garland
2 Rowlett
3 Rockwall
4 White Rock Lake
5 Forney North
6 Hutchins
7 Seagoville

U.S. National Grid
100,000-m Square ID
QB
Grid Zone Designation

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

MESQUITE, TX

2016

Attachment F

General Description

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

LAKE HUBBARD STEAM ELECTRIC STATION
GENERAL DESCRIPTION

The Lake Hubbard Steam Electric Station is a two-unit gas-fired electric generating facility owned and operated by Luminant Generation Company, LLC (Luminant). The facility is located on the west shore of Ray Hubbard Reservoir at 555 Barnes Bridge Road, Sunnyvale, Dallas County, Texas. Wastewater discharges are authorized by TPDES Permit No. WQ0001245000. Wastewaters are discharged to Ray Hubbard Reservoir in Segment No. 0820 of the Trinity River Basin. Cooling water and boiler make-up water are supplied by Ray Hubbard Reservoir. The City of Sunnyvale municipal water plant (PWS ID TX0570059) supplies the facility's potable water and serves as an alternate source of boiler make-up water. The generating capacity and date of initial commercial operation for the facility's two units are as follows:

Unit	Capacity (Mw)	Date
1	375	1970
2	515	1973

Wastewaters produced at the plant site consist of once-through and auxiliary cooling, low volume wastes (floor/equipment drains, boiler blowdown and water treatment wastes), metal cleaning wastes, storm water runoff and domestic wastes. Wastewaters generated by the facility are collected, treated and discharged via two (2) permitted outfalls. Domestic wastes are discharged to the City of Garland (Duck Creek Plant) sanitary sewer system. Luminant's operating procedures and wastewater handling practices are designed both to comply with all applicable environmental regulations and to provide operational flexibility wherever practical.

The Company is aware of an increased potential for macroinvertebrate invasion of any plant water system. In the event of such occurrence, the Company is prepared to treat its water on a static or flow through basis with a non-oxidizing biocide (e.g. Spectrus CT-1300) or by supplementing chlorination with ammonia to create chloramines.

The two permitted outfalls are listed below and a description of the wastewater system pertinent to each outfall follows:

Outfall	Type of Wastewater
001	once-through cooling water and previously monitored effluents
101	low volume wastes, metal cleaning waste and storm water runoff

Outfall 001 (Once-through Cooling and Previously Monitored Effluents)

Water from Ray Hubbard Reservoir is withdrawn at the intake structure, treated chemically and then passed through condensers and auxiliary equipment on a once-through basis to cool equipment and condense exhaust steam. This water is treated with sodium hypochlorite to prevent biofouling and/or sodium bromide as a chlorine enhancer to improve efficacy and thereby reduce chlorine feed rates; application of these substances is intermittent and does not exceed the regulatory maximum frequency of two (2) hours/unit/day. Once-through cooling water is also treated with various chemicals to prevent scale and corrosion of the cooling water system equipment. Safety Data Sheets of the current Once-through cooling chemicals are included in Attachment H of the permit application. The once-through and auxiliary cooling

wastewater streams are commingled and discharged from the 1500-foot Discharge Canal to Ray Hubbard Reservoir via Outfall 001.

Outfall 101 (Low Volume Wastes, Metal Cleaning Waste and Storm Water Runoff)

All low volume wastes, as well as storm water runoff from yard drains and diked oil storage areas, are discharged to the Discharge Canal or the cooling water intake area via Outfall 101. Boiler blowdown is discharged directly to the Discharge Canal. Floor/equipment drains, and storm water runoff are passed through oil/water separators prior to discharge. Water treatment wastes from the regeneration of demineralizers and reject wastewater flows from a reverse osmosis unit are treated, as necessary, in an elementary neutralization facility prior to being discharged to the Discharge Canal. Reverse osmosis membranes are periodically treated, as needed to control biofouling. Water treatment wastes from the blowdown of clarifiers and the backwash of sand filters are routed to the City of Garland (Duck Creek WWTP) sanitary sewer system. Whenever necessary, flow-weight composite samples are used for analysis and reporting. Metal cleaning wastes from equipment cleaning are generally disposed off-site; however, discharge via Outfall 101 is a permitted option provided compliance with the pertinent effluent limitations is assured. Safety Data Sheets of the current boiler chemicals are included in Attachment G of the permit application

Storm Water Management

Storm water runoff from yard drains, construction areas/activities and diked oil storage areas are discharged to the Discharge Canal or the cooling water intake area via Outfall 001.

Other areas in which storm water runoff may be exposed to industrial processes are permitted under the TCEQ's Multi-Sector General Permit (Permit No. TXR05W669)

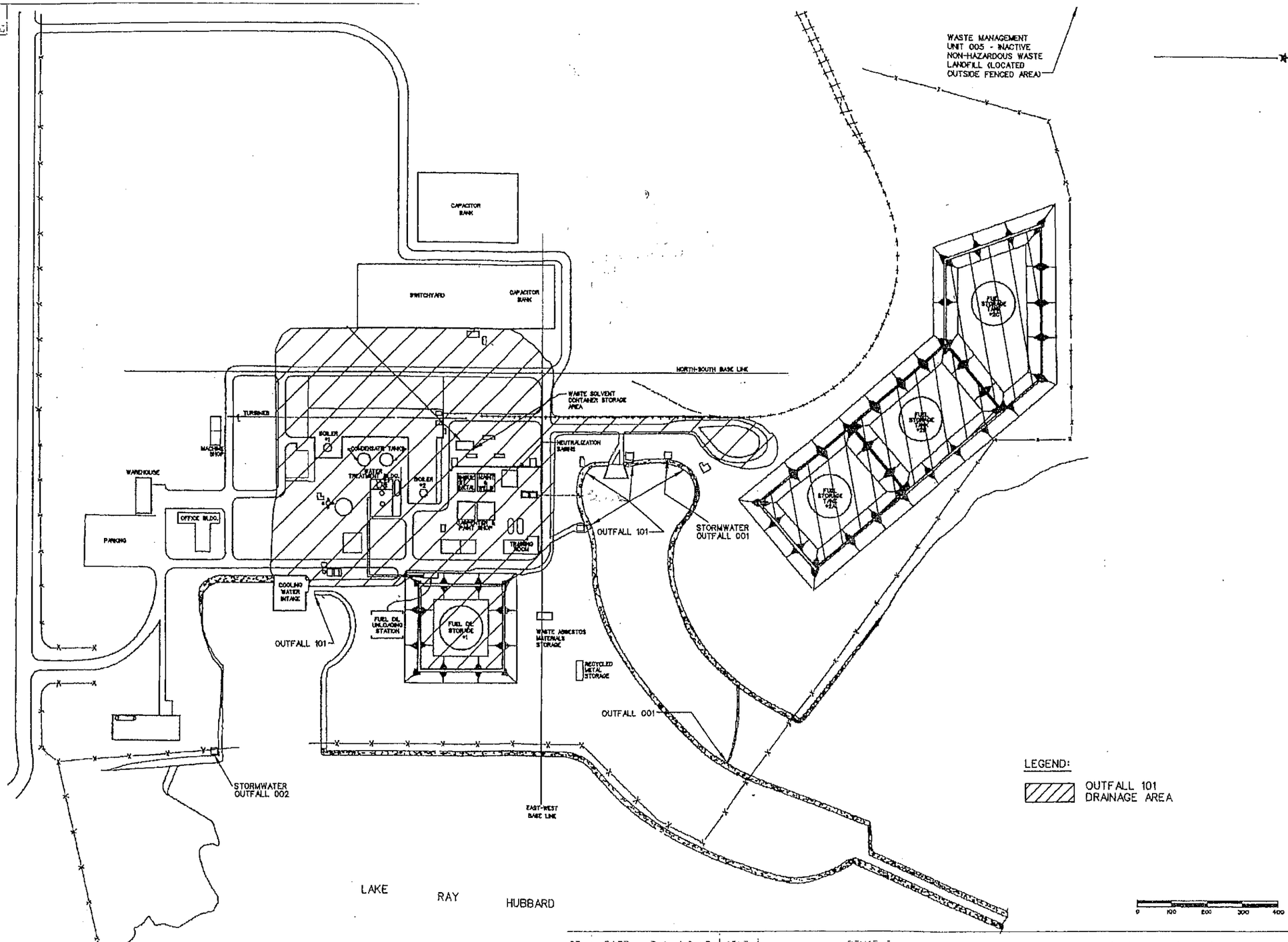
Attachment G

Facility Map

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

SK-459-1009

1



REV.	DATE	DWN.	CHKD.	APVD.	REMARKS
0		JLF			

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station

WASTE WATER DISCHARGE
FACILITY MAP
FEBRUARY 2006

DWG. NO.	SH. NO.	REV.
SK-459-1009	1	0

000362911.dgn

Attachment H

Water balance Diagram

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Attachment D
Water Balance Diagram
Lake Hubbard Steam Electric
All flows in MGD unless stated otherwise

Intake Structure
Once-Through And Auxiliary Cooling
Discharge Canal
870
Outfall 001
Lake Ray Hubbard
0.757 + runoff
Lake Ray Hubbard
0.648
Miscellaneous Uses
0.648
Plant Floor Drains
Yard Drains
0.648 + runoff
Oil / Water Separators (NO. 1-4)
0.648 + runoff
Outfall 101
0.027 RORW/IXW
Neutralization Tank
0.158
Primary Make-Up Water
Clarifier
0.1433
Sand Filter
0.109
Water Treatment System
0.082
Boilers (Unit 1 & 2)
0.082
0.0147
0.0343
Equipment Cleaning
Metal Cleaning Waste
Off-Site Disposal
Annual Precipitation
33.18 MGY
36'/yr avg.
0.049
Alternate Make-Up Water
City of Sunnyvale Municipal Water
Potable Water Use
0.001
0.05
City of Garland Sanitary Sewer

Flows Based on Two Unit Operation
Normal Flow
Intermittent Flow
Infrequent Discharge
No Anticipated Discharge
URE Unable to Reasonably Estimate

April 2019

Attachment K

Contract Laboratory Inforamtion

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000
Worksheet 2.0 – Pollutant Analysis Requirements

Outfall 001 is an external, continuous discharge of non-process Once-Through Cooling Water. As required by the permit application, the outfall was sampled for four consecutive weeks beginning 07/16/2024 and submitted for the laboratory analysis of the parameters listed in Tables 1, 2, 3 (partial list), 6, 8 and 9.

Outfall 101 is an internal discharge to Outfall 001; therefore, characterization sampling is not required.

Characterization analysis was performed by the following entities:

1. Temperature, pH and Total Residual Chlorine analysis was performed by company personnel.

2. All other analysis was performed by SPL, LLC., 1825 E. Plano Pkwy Suite 160, Plano, Texas 75074, (972-424-6508).

Attachment J

Once-Through Cooling Chemical Additives

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Once-Through Cooling Chemical Additives

- Manufacturers Product Identification Number: **Sodium Hypochlorite**
- Product Use: **Biocide (oxidizing)**
- Chemical Composition: **NaOCl**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Intermittent use; not exceeding 2 hours/day/unit**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Detectable**
- Outfall: **001**

Safety Data Sheet

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: DIXICHLOR
Synonyms: Bleach, Sodium Hypochlorite, Sodium Hypochlorite 10%
Intended use: Swimming pool chlorinator, Hard surface cleaner, Water treatment chemical, Biocides
Uses Advised Against: None identified. This is a pesticide product, do not use in a pesticide application that is not included on the label.

Company Identification
DPC Industries, Inc.
DPC Enterprises, LP
DXI Industries, Inc.
DX Terminals
PO Box 24600
Houston , TX 77229-4600

Emergency
CHEMTREC (USA) (800) 424-9300
24 hour Emergency Telephone No. (281) 457-4888
www.dxgroup.com

2. Hazard identification of the product

Physical hazards	Corrosive to metals	Category 1
Health hazards	Skin corrosion/irritation	Category 1
	Serious eye damage/eye irritation	Category 1
	Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 2

Label elements
Using the Toxicity Data listed in section 11 and 12 the product is labeled as follows.

Signal Word	**Danger**
Hazard Statements	Harmful in contact with skin. Causes severe skin burns and eye damage. Causes serious eye damage. Very toxic to aquatic life. Toxic to aquatic life with long lasting effects. May be corrosive to metals
Precautionary Statements	
Prevention	Do not breathe mist / vapors / spray. Wash thoroughly after handling. Avoid release to the environment. Wear protective gloves / eye protection / face protection. Use in well ventilated area.
Response	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN: Remove / Take off immediately all contaminated clothing. Wash with plenty of soap and water. IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor / physician if you feel unwell. IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing. Immediately call a POISON CENTER or doctor / physician. Wash contaminated clothing before reuse. Collect spillage.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up. Protect from sunlight.
Disposal	Dispose of contents / container in accordance with local / national regulations.

3. Composition/information on ingredients

Synonyms: Bleach, Sodium Hypochlorite, Sodium Hypochlorite 10%

Ingredient	CAS Number	Percent (%)	NOTES
Sodium hypochlorite	7681-52-9	10 – 12.49	Substance classified with a health or environmental hazard.
Sodium chloride	7647-14-5	7 - 8	Substance classified with a health or environmental hazard.
Sodium hydroxide	1310-73-2	.1 - 5	Substance classified with a health or environmental hazard. Substance with a workplace exposure limit.

4. First aid measures

General	Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
Inhalation	Move victim to fresh air. Call emergency medical care. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult.
Eyes	Irrigate copiously with clean fresh water for at least 10 minutes, holding the eyelids apart. Get medical attention. Remove contact lenses if present and easy to do - continue rinsing.
Skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a recognized skin cleanser. Do NOT use solvents or thinners.
Ingestion	If accidentally swallowed obtain immediate medical attention. Rinse mouth. Keep at rest. Do NOT induce vomiting. If vomiting occurs, keep head low so that stomach content does not get into lungs.
Most important symptoms and effects, both acute and delayed	
Overview	Corrosive effects. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.
Indication of immediate medical attention and special treatment needed	Treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Recommended Extinguishing media	Alcohol resistant foam, CO^2, dry chemical powder, water spray. Do not use water jet.
Special hazards arising from the substance or mixture	Hydrogen chloride and chlorine. Chlorine gas rate of decomposition increases with the concentration with temperatures above 85 °F (30 °C). Do not breathe mist / vapors / spray.
Advice for fire-fighters	Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection. Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible. Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Some are oxidizers and may ignite combustibles (wood, paper, oil, clothing, etc.). Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated. TOXIC; inhalation, ingestion or skin contact with material may cause severe injury or death. Avoid any skin contact. Contact with molten substance may cause severe burns to skin and eyes. Effects of contact or inhalation may be delayed. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution. ERG Guide No. 154

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Local authorities should be contacted if significant spill cannot be contained.
Environmental precautions	Do not allow spills to enter drains or watercourses.
Methods and material for containment and cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills in original containers for re-use. For waste disposal, see Section 13 of the SDS.

7. Handling and storage

Precautions for safe handling	Wear appropriate personal protective equipment. Do not get in eyes, on skin, on clothing. Chemical attack increases with solution strength. Use with adequate ventilation. Observe good industrial hygiene practices. Do not apply heat or direct sunlight. Temperature and product concentration affect product quality and decomposition rates.
Conditions for safe storage, including any incompatibilities	Handle containers carefully to prevent damage and spillage. Keep container tightly closed. Store in a cool and well-ventilated place. Store in a corrosive resistant container. Consult container manufacturer for additional guidance. Store away from and do not mix with incompatible materials such as acids, ammonia, urea, oxidizers, organics and metals such as nickel, copper, tin, aluminum and iron.

8. Exposure controls and personal protection

Exposure Control parameters

CAS No.	Ingestion	Source	Value
1310-73-2	Sodium hydroxide	OSHA	TWA 2 mg/m3
		ACGIH	Ceiling: 2 mg/m3
		NIOSH	C 2 mg/m3
7647-14-5	Sodium chloride	OSHA	No Established Limit
		ACGIH	No Established Limit
		NIOSH	No Established Limit
7681-52-9	Sodium hypochlorite.	OSHA	No Established Limit
		ACGIH	No Established Limit
		NIOSH	No Established Limit

Individual protection measures, such as personal protective equipment

Respiratory	Use NIOSH/MSHA approved respirator, following manufacturer's recommendations when concentrations exceed permissible exposure limits.
Eyes	Wear face shield with safety glasses with side shields and/or safety goggles.
Skin	Chemical resistant clothing such as coveralls/apron boots should be worn. Chemical Impervious gloves.
Engineering Controls	Provide adequate ventilation. Where reasonably practicable this should be achieved by the use of local exhaust ventilation and good general extraction. If these are not sufficient to maintain concentrations of particulates and any vapor below occupational exposure limits suitable respiratory protection must be worn. Eye wash and safety shower must be available when handling this product
Other Work Practices	Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

9. Physical and chemical properties

Appearance	Clear, pale yellow, or greenish Liquid
Odor	Pungent, chlorine odor
Odor threshold	0.9 mg/m^3
pH	12 - 13
Melting point / freezing point	7 °F (-13.9 °C)
Initial boiling point and boiling range	Decomposes above 230 °F (110 °C)
Flash Point	Nonflammable
Evaporation rate (Ether = 1)	Not Established
Flammability (solid, gas)	Not Applicable
Upper/lower flammability or explosive limits	**Lower Explosive Limit:** Not Measured **Upper Explosive Limit:** Not Measured
Vapor pressure (mmHg)	17.5 (@ 20 °C)
Vapor Density	Not Established
Specific Gravity	1.20 - 1.40
Solubility in Water	Complete
Partition coefficient n-octanol/water (Log Kow)	Not Measured
Auto-ignition temperature (°C)	Not Measured
Decomposition temperature	Not Measured
Viscosity (cSt)	Not Measured
VOC %	Not Measured
Other information	No other relevant information.

10. Stability and reactivity

Reactivity:	Hazardous Polymerization will not occur.
Chemical stability:	Stable under normal circumstances.
Possibility of hazardous reactions:	No data available.
Conditions to avoid:	Contact with incompatible materials. Acid contact will produce chlorine gas.
Incompatible materials:	Any acidic material, ammonia, urea, oxidizers, organics and metals such as nickel, copper, tin, aluminum and iron.
Hazardous decomposition products:	No hazardous decomposition products are known.

11. Toxicological information

Acute toxicity

Ingredient	Oral LD50, mg/kg	Skin LD50, mg/kg	Inhalation Vapor LC50, mg/L/4hr	Inhalation Dust/Mist LC50, mg/L/4hr	Inhalation Gas LC50, ppm
Sodium hypochlorite (7681-52-9)	5,000.00, Rat - Category: 5	10,000.00, Rabbit - Category: NA	10.50, Rat - Category: 4	No data available	No data available
Sodium chloride (7647-14-5)	1,350.00, Rabbit - Category: 4	100.00, Rat - Category: 2	40.00, Mouse - Category: NA	10,500.00, Rat - Category: NA	No data available
Sodium hydroxide (1310-73-2)	6,600.00, Mouse - Category: NA	1,350.00, Rabbit - Category: 4	600.00, Mouse - Category: NA	No data available	No data available

11. Toxicological information

Acute toxicity (cont.)

Item	Hazard
Acute Toxicity (mouth)	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. Ingestion may produce burns to the lips, oral cavity, upper airway, esophagus and possibly the digestive tract.
Acute Toxicity (skin)	Harmful in contact with skin.
Acute Toxicity (inhalation)	Vapors and spray mist may irritate throat and respiratory system and cause coughing.
Skin corrosion/irritation	Causes severe skin burns and eye damage
Eye damage/irritation	Causes serious eye damage.
Sensitization (respiratory)	No data available.
Sensitization (skin)	No data available.
Germ toxicity	No data available.
Carcinogenicity	Not considered to be a carcinogen by IARC, ACGIH, NTP or OSHA.
Reproductive Toxicity	No data available.
Specific target organ systemic toxicity (single exposure)	May cause respiratory irritation.
Specific target organ systemic Toxicity (repeated exposure)	Not Applicable.
Aspiration hazard	Not classified; however droplets of product may be aspirated into lungs, through ingestion or vomiting and may cause serious chemical pneumonia.

12. Ecological information

Toxicity: Very toxic to aquatic life. Toxic to aquatic life with long lasting effects.

Aquatic Ecotoxicity

Ingredient	96 hr LC50 fish, mg/l	48 hr EC50 crustacea, mg/l	ErC50 algae, mg/l
Sodium hypochlorite (7681-52-9)	0.08, Pimephales promelas	0.032, Daphnia magna	0.40 (72 hr),Dunaliella primolecta
Sodium chloride (7647-14-5)	1,100.00, Freshwater Fish	3,310.00, Daphnia magna	Not Available
Sodium hydroxide (1310-73-2)	196.00, Poecilia reticulata	40.38, Ceriodaphnia dubia	Not Available

Persistence and degradability	There is no data available on the preparation itself.
Bioaccumulative potential	Not Measured
Mobility in soil	No data available.
Results of PBT and vPvB assessment	This product contains no PBT/vPvB chemicals.
Other adverse effects	No other effects are expected.

13. Disposal considerations

Waste treatment methods:	Do not allow into drains or water courses. Wastes and emptied containers should be disposed of in accordance with regulations made under the Control of Pollution Act and the Environmental Protection Act. Using information provided in this data sheet, advice should be obtained from the Waste Regulation Authority, whether the special waste regulations apply.
Waste from material:	The waste determination should be made in discussion between the user and the waste disposal company.
Container Management:	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

UN number:	UN1791
UN proper shipping name:	Hypochlorite solutions
Transport hazard class(es)	
DOT (Domestic Surface Transportation)	
DOT Proper Shipping Name:	Hypochlorite solutions
DOT Hazard Class **DOT Label:**	8 8
UN / NA Number:	UN1791
DOT Packing Group:	III
CERCLA/DOT RQ:	100 lbs.
Environmental hazards:	IMDG Marine Pollutant: Yes (Sodium hypochlorite)
Special precautions for user:	Not Applicable

15. Regulatory information

Regulatory Overview:	The regulatory data in Section 15 is not intended to be all-inclusive, only selected regulations are represented. All ingredients of this product are listed on the TSCA (Toxic Substance Control Act) Inventory.	
WHMIS Classification	D2B E	
US EPA Tier II Hazards:	**Fire:**	No
	Sudden Release of Pressure:	No
	Reactive:	No
	Immediate (Acute):	Yes
	Delayed (Chronic):	No
SARA 302 Extremely Hazardous Substance:		No
SARA 311/312 Chemicals and RQs (lbs) (>0.1%) :		100
SARA 313 (TRI)		No
CAA Section 112 Hazardous Air Pollutant		No
CAA Section 112R Risk Management Plan		No
State Regulations:	**N.J. RTK Substances (>1%)**	Listed
	Penn RTK Substances (>1%)	Listed
	California Prop 65	Not Listed

16. Other information:

EPA Registration Number: 813-16

NSF Maximum Use Level (STD 60): Check BOL for facility Data. (46 to 105 mg/L)

Revision Information: 5/4/2017 – Section 3: Revised EPA registration.

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to our products. Customers/users of this product must comply with all applicable health and safety laws, regulations, and orders.

THE USER IS CAUTIONED TO PERFORM HIS OWN HAZARD EVALUATION AND TO RELY ON HIS OWN DETERMINATIONS.

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Once-Through Cooling Chemical Additives

- Manufacturers Product Identification Number: **Spectrus CT-1300**
- Product Use: **Biocide (non-oxidizing)**
- Chemical Composition: **See attached data sheets**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Intermittent use as needed**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Detectable**
- Outfall: **001**

SAFETY DATA SHEET
SPECTRUS* CT1300

1. Identification

Product identifier	**SPECTRUS CT1300**
Other means of identification	None.
Recommended use	Water-based microbial control agent.
Recommended restrictions	None known.

Company/undertaking identification

SUEZ WTS USA, Inc.
4636 Somerton Road
Trevose, PA 19053
T 215 355 3300, F 215 953 5524

Emergency telephone

(800) 877 1940

2. Hazard(s) identification

Physical hazards	Flammable liquids	Category 3
Health hazards	Acute toxicity, oral	Category 4
	Skin corrosion/irritation	Category 1B
	Serious eye damage/eye irritation	Category 1
	Reproductive toxicity	Category 1A
	Reproductive toxicity	Effects on or via lactation
	Specific target organ toxicity, single exposure	Category 3 narcotic effects
	Specific target organ toxicity, repeated exposure (oral)	Category 1 (liver)
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	Flammable liquid and vapor. Harmful if swallowed. Causes severe skin burns and eye damage. Causes serious eye damage. May cause drowsiness or dizziness. May damage fertility or the unborn child. May cause harm to breast-fed children. Causes damage to organs (liver) through prolonged or repeated exposure by ingestion.

Precautionary statement

Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting// equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Do not breathe mist or vapor. Avoid contact during pregnancy/while nursing. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection.
Response	If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor/. Specific treatment (see on this label). Wash contaminated clothing before reuse. In case of fire: Use to extinguish.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store in a well-ventilated place. Keep cool. Store locked up.
Disposal	Dispose of contents/container to an approved facility.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Components	CAS #	Percent
Alkyl dimethyl benzyl ammonium chloride	68424-85-1	40 - 60
Ethanol	64-17-5	10 - 20

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

Composition comments	Information for specific product ingredients as required by the U.S. OSHA HAZARD COMMUNICATION STANDARD is listed. Refer to additional sections of this SDS for our assessment of the potential hazards of this formulation.

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of low-pressure water for at least 30 minutes while removing contact lenses. Continue rinsing. Call a physician or poison control center immediately.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Most important symptoms/effects, acute and delayed	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Vapors have a narcotic effect and may cause headache, fatigue, dizziness and nausea. Jaundice. Prolonged exposure may cause chronic effects.
General information	Take off all contaminated clothing immediately. IF exposed or concerned: Get medical advice/attention. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media	Alcohol resistant foam. Dry chemical powder. Carbon dioxide (CO2). Avoid water if possible.
Unsuitable extinguishing media	Water.
Specific hazards arising from the chemical	Vapors may form explosive mixtures with air. Vapors may travel considerable distance to a source of ignition and flash back. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. Move containers from fire area if you can do so without risk. Cool containers / tanks with water spray.

General fire hazards	Flammable liquid and vapor.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep out of low areas. Wear appropriate protective equipment and clothing during clean-up. Do not breathe mist or vapor. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep combustibles (wood, paper, oil, etc.) away from spilled material. Take precautionary measures against static discharge. Use only non-sparking tools. Prevent entry into waterways, sewer, basements or confined areas. Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground. Do not empty into drains, dispose of this material and its container to hazardous or special waste collection point.

7. Handling and storage

Precautions for safe handling	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Vapors may form explosive mixtures with air. Do not handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. Take precautionary measures against static discharges. All equipment used when handling the product must be grounded. Use non-sparking tools and explosion-proof equipment. Do not breathe mist or vapor. Do not get this material in contact with eyes. Do not get this material in contact with skin. Do not taste or swallow. Do not get this material on clothing. Avoid contact during pregnancy/while nursing. Avoid prolonged exposure. When using, do not eat, drink or smoke. Provide adequate ventilation. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store locked up. Keep away from heat, sparks and open flame. Prevent electrostatic charge build-up by using common bonding and grounding techniques. Store in a cool, dry place out of direct sunlight. Store in original tightly closed container. Store in a well-ventilated place. Refrigeration recommended. Keep in an area equipped with sprinklers. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Ethanol (CAS 64-17-5)	PEL	1900 mg/m3 1000 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
Ethanol (CAS 64-17-5)	STEL	1000 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Ethanol (CAS 64-17-5)	TWA	1900 mg/m3 1000 ppm

Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Explosion-proof general and local exhaust ventilation. Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection	
Hand protection	Chemical resistant gloves. The choice of an appropriate glove does not only depend on its material but also on other quality features and is different from one producer to the other. Glove selection must take into account any solvents and other hazards present.
Other	Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.
Respiratory protection	Chemical respirator with organic vapor cartridge and full facepiece. A RESPIRATORY PROTECTION PROGRAM THAT MEETS OSHA'S 29 CFR 1910.134 AND ANSI Z88.2 REQUIREMENTS MUST BE FOLLOWED WHENEVER WORKPLACE CONDITIONS WARRANT A RESPIRATOR'S USE.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	When using, do not eat, drink or smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Color	Colorless to yellow
Physical state	Liquid
Odor	Mild
Odor threshold	Not available.
pH (concentrated product)	7.5 Neat
pH in aqueous solution	6.3 (10% Solution)
Melting point/freezing point	-7 °F (-22 °C)
Initial boiling point and boiling range	Not available.
Flash point	129 °F (54 °C) P-M(CC)
Evaporation rate	Slower than Ether
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	44 mmHg
Vapor pressure temp.	70 °F (21 °C)
Vapor density	< 1
Relative density	0.96
Relative density temperature	70 °F (21 °C)
Solubility(ies)	
Solubility (water)	100 %
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	73 mPa.s
Viscosity temperature	70 °F (21 °C)
Other information	
Pour point	-2 °F (-19 °C)
Specific gravity	0.965

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.

Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Avoid heat, sparks, open flames and other ignition sources. Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	Thermal decomposition or combustion may produce oxides of carbon, ammonia, oxides of nitrogen and/or hydrogen chloride.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause damage to organs by inhalation. May cause irritation to the respiratory system. Vapors have a narcotic effect and may cause headache, fatigue, dizziness and nausea. Prolonged inhalation may be harmful.
Skin contact	Causes severe skin burns.
Eye contact	Causes serious eye damage.
Ingestion	Causes digestive tract burns. Harmful if swallowed.
Symptoms related to the physical, chemical and toxicological characteristics	Burning pain and severe corrosive skin damage. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Jaundice.

Information on toxicological effects

Acute toxicity Narcotic effects.

Product	Species	Test Results
SPECTRUS CT1300 (CAS Mixture)		
Acute		
Dermal		
LD50	Rabbit	> 5000 mg/kg, (Calculated according to GHS additivity formula)
Oral		
LD50	Rat	688 mg/kg, (Calculated according to GHS additivity formula)

Components	Species	Test Results
Alkyl dimethyl benzyl ammonium chloride (CAS 68424-85-1)		
Acute		
Dermal		
LD50	Rabbit	3340 mg/kg
Oral		
LD50	Rat	344 mg/kg
Ethanol (CAS 64-17-5)		
Acute		
Dermal		
LD50	Rabbit	> 5000 mg/kg
Inhalation		
LC50	Rat	124.7 mg/l/4h
Oral		
LD50	Rat	> 5000 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Causes severe skin burns.
Serious eye damage/eye irritation	Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization	This product is not expected to cause respiratory sensitization.
Skin sensitization	This product is not expected to cause skin sensitization.

Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity	Possible reproductive hazard. May cause harm to breastfed babies. May damage fertility or the unborn child.
Specific target organ toxicity - single exposure	Narcotic effects.
Specific target organ toxicity - repeated exposure	Causes damage to organs (Liver) through prolonged or repeated exposure by ingestion.
Aspiration hazard	May be harmful if swallowed and enters airways. Based on available data, the classification criteria are not met.
Chronic effects	Prolonged or repeated exposures may cause CNS depression, tissue necrosis, and/or toxicity to the liver and kidney. Causes damage to organs through prolonged or repeated exposure.

12. Ecological information

Ecotoxicity

Product		Species	Test Results
SPECTRUS CT1300 (CAS Mixture)			
	IC25	Ceriodaphnia	0.098 mg/L, Chronic Bioassay, 7 day
		Fathead Minnow	0.259 mg/L, Chronic Bioassay, 7 day
	LC10	Annelida(Lumbriculus variegatus)	0.37 mg/L, Acute Toxicity, 96 hour
	LC50	Annelida(Lumbriculus variegatus)	1.47 mg/L, Acute Toxicity, 96 hour
		Benthic Crustacean(Gammerus pseutolimnaeus)	0.07 mg/L, Acute Toxicity, 96 hour
		Ceriodaphnia	0.35 mg/L, Static Renewal Bioassay, 48 hour
		Channel Catfish	0.86 mg/L, Acute Toxicity, 96 hour
		Fathead Minnow	0.72 mg/L, Flow-Thru Bioassay, 96 hour
		Freshwater Snail(Physa sp.)	0.46 mg/L, Acute Toxicity, 96 hour
		Menidia beryllina (Silversides)	0.62 mg/L, Flow-Thru Bioassay, 96 hour
		Midge larvae (Chironomus tentans)	0.5 mg/L, Acute Toxicity, 96 hour
		Mysid Shrimp	0.16 mg/L, Flow-Thru Bioassay, 96 hour
		Sheepshead Minnow	1.76 mg/L, Flow-Thru Bioassay, 96 hour
	NOEL	Ceriodaphnia	0.15 mg/L, Static Renewal Bioassay, 48 hour
		Channel Catfish	0.54 mg/L, Acute Toxicity, 96 hour
		Fathead Minnow	0.41 mg/L, Flow-Thru Bioassay, 96 hour
		Freshwater Snail(Physa sp.)	0.36 mg/L, Acute Toxicity, 96 hour
		Menidia beryllina (Silversides)	0.35 mg/L, Flow-Thru Bioassay, 96 hour
		Midge larvae (Chironomus tentans)	0.13 mg/L, Acute Toxicity, 96 hour
		Mysid Shrimp	0.03 mg/L, Flow-Thru Bioassay, 96 hour
		Sheepshead Minnow	1 mg/L, Flow-Thru Bioassay, 96 hour
Aquatic			
Crustacea	LC50	Daphnia magna	0.11 mg/L, Static Acute Bioassay, 48 hour
			0.04 mg/L, Flow-Thru Bioassay, 48 hour

Product		Species	Test Results
		Daphnia pulex	0.05 mg/L, Static Renewal Bioassay, 48 hour
	NOEL	Daphnia magna	0.06 mg/L, Static Acute Bioassay, 48 hour
			0.026 mg/L, Flow-Thru Bioassay, 48 hour
		Daphnia pulex	0.031 mg/L, Static Renewal Bioassay, 48 hour
Fish	LC50	Rainbow Trout	2 mg/L, Flow-Thru Bioassay, 96 hour
	NOEL	Rainbow Trout	1.2 mg/L, Flow-Thru Bioassay, 96 hour

Components		Species	Test Results
Alkyl dimethyl benzyl ammonium chloride (CAS 68424-85-1)			
	EC50	Active Sludge	10 mg/l
		Daphnia Magna	0.016 mg/l, 48 hour
Aquatic			
Fish	LC50	Rainbow Trout	0.93 mg/l, 96 hour

Bioaccumulative potential No data available.

Partition coefficient n-octanol / water (log Kow)
Ethanol -0.31

Mobility in soil No data available.

Other adverse effects Not available.

Persistence and degradability

66% CO_2 Evolution (Modified Sturm Test) (OECD 301B)

- COD (mgO2/g)	1470
- BOD 5 (mgO2/g)	43
- BOD 28 (mgO2/g)	156
- Closed Bottle Test (% Degradation in 28 days)	14
- Zahn-Wellens Test (% Degradation in 28 days)	0
- TOC (mg C/g)	380
- CO2 evolution (modified Sturm test)	66

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Incinerate the material under controlled conditions in an approved incinerator. Do not incinerate sealed containers. If discarded, this product is considered a RCRA ignitable waste, D001. Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazardous waste code D001: Waste Flammable material with a flash point <140 F
The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number UN2920

UN proper shipping name	Corrosive liquids, flammable, n.o.s. (ETHANOL, QUATERNARY AMMONIUM COMPOUNDS), RQ(ETHANOL, Methanol)
Transport hazard class(es)	
Class	8
Subsidiary risk	3
Packing group	II
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
ERG number	132

Some containers may be exempt from Dangerous Goods/Hazmat Transport Regulations, please check BOL for exact container classification.

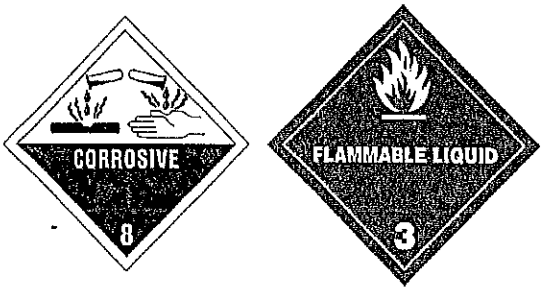
IATA

UN number	UN2920
UN proper shipping name	CORROSIVE LIQUID, FLAMMABLE, N.O.S. (Quaternary Ammonium Compounds; Ethanol)
Transport hazard class(es)	
Class	8
Subsidiary risk	3
Packing group	II
Environmental hazards	Yes
ERG Code	132
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

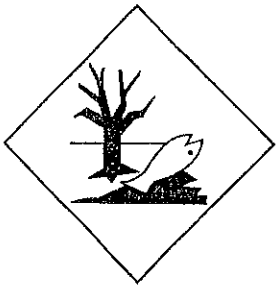
UN number	UN2920
UN proper shipping name	CORROSIVE LIQUID, FLAMMABLE, N.O.S. (ETHANOL, QUATERNARY AMMONIUM COMPOUNDS), RQ(ETHANOL), MARINE POLLUTANT
Transport hazard class(es)	
Class	8
Subsidiary risk	3
Packing group	II
Environmental hazards	
Marine pollutant	Yes
EmS	F-E, S-C
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

DOT



IATA; IMDG

Marine pollutant



General information IMDG Regulated Marine Pollutant.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Ethanol (CAS 64-17-5) Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - Yes
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

FIFRA registration number 3876-149

TSCA This is an EPA registered biocide and is exempt from TSCA inventory requirements.

FIFRA hazard statement	This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets, and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label: DANGER Corrosive Causes irreversible eye damage and skin burns May be fatal if swallowed, absorbed through the skin, or inhaled This pesticide is toxic to fish
Food and drug administration	21 CFR 176.300 (slimicides for wet end use)

US state regulations

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Ethanol (CAS 64-17-5)	Listed: April 29, 2011 Listed: July 1, 1988

US - California Proposition 65 - CRT: Listed date/Developmental toxin

Ethanol (CAS 64-17-5)	Listed: October 1, 1987
Methanol (CAS 67-56-1)	Listed: March 16, 2012

US - California Proposition 65 - CRT: Listed date/Female reproductive toxin

No ingredient listed.

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

No ingredient listed.

US - Massachusetts RTK - Substance List

Ethanol (CAS 64-17-5)

US - Pennsylvania RTK - Hazardous Substances

Ethanol (CAS 64-17-5)	Listed.

US - Rhode Island RTK

Ethanol (CAS 64-17-5)

US. New Jersey Worker and Community Right-to-Know Act

Ethanol (CAS 64-17-5)	Listed.

US. Pennsylvania Worker and Community Right-to-Know Law

Ethanol (CAS 64-17-5)	Hazardous substance

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

16. Other information, including date of preparation or last revision

Issue date	Dec-18-2014
Revision date	Apr-09-2018
Version #	1.1
List of abbreviations	CAS: Chemical Abstract Service Registration Number TWA: Time Weighted Average STEL: Short Term Exposure Limit LD50: Lethal Dose, 50% LC50: Lethal Concentration, 50% NOEL: No Observed Effect Level COD: Chemical Oxygen Demand BOD: Biochemical Oxygen Demand TOC: Total Organic Carbon IATA: International Air Transport Association IMDG: International Maritime Dangerous Goods Code ACGIH: American Conference of Governmental Industrial Hygienists TSRN indicates a Trade Secret Registry Number is used in place of the CAS number.
References:	No data available
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
Revision information	This document has undergone significant changes and should be reviewed in its entirety.

Prepared by This SDS has been prepared by SUEZ Regulatory Department (1-215-355-3300).

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Once-Through Cooling Chemical Additives

- Manufacturers Product Identification Number: **Nalco Thruguard THR404**
- Product Use: **Water Treatment**
- Chemical Composition: **See attached data sheets**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Intermittent use as needed.**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Detectable**
- Outfall: **001**

NALCO
An Ecolab Company

SAFETY DATA SHEET

THRUGUARD THR404

Section: 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	THRUGUARD THR404
Other means of identification	:	Not applicable.
Recommended use	:	WATER TREATMENT
Restrictions on use	:	Refer to available product literature or ask your local Sales Representative for restrictions on use and dose limits.
Company	:	Nalco Company 1601 W. Diehl Road Naperville, Illinois 60563-1198 USA TEL: (630)305-1000
Emergency telephone number	:	(800) 424-9300 (24 Hours) CHEMTREC
Issuing date	:	10/15/2015

Section: 2. HAZARDS IDENTIFICATION

GHS Classification

Skin corrosion	:	Category 1A
Serious eye damage	:	Category 1

GHS Label element

Hazard pictograms :

Signal Word : Danger

Hazard Statements : Causes severe skin burns and eye damage.

Precautionary Statements :

Prevention:
Wash skin thoroughly after handling. Wear protective gloves/ protective clothing/ eye protection/ face protection. Do not mix with bleach or other chlorinated products – will cause chlorine gas.
Response:
IF SWALLOWED: rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician. Wash contaminated clothing before reuse.
Storage:
Store locked up.
Disposal:

Dispose of contents/ container to an approved waste disposal plant.

Other hazards : None known.

Section: 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance/mixture : Mixture

Mixture

Chemical Name	CAS-No.	Concentration: (%)
Hydroxyethylidenediphosphonic Acid	2809-21-4	30 - 60
Phosphonic Acid	13598-36-2	1 - 5

Section: 4. FIRST AID MEASURES

In case of eye contact : Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately.

In case of skin contact : Wash off immediately with plenty of water for at least 15 minutes. Use a mild soap if available. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

If swallowed : Rinse mouth with water. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Get medical attention immediately.

If inhaled : Remove to fresh air. Treat symptomatically. Get medical attention if symptoms occur.

Protection of first-aiders : In event of emergency assess the danger before taking action. Do not put yourself at risk of injury. If in doubt, contact emergency responders. Use personal protective equipment as required.

Notes to physician : Treat symptomatically.

Most important symptoms and effects, both acute and delayed : See Section 11 for more detailed information on health effects and symptoms.

Section: 5. FIREFIGHTING MEASURES

Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media : None known.

Specific hazards during firefighting : Not flammable or combustible.

Hazardous combustion products : Carbon oxides Oxides of phosphorus

Special protective equipment for firefighters	:	Use personal protective equipment.
Specific extinguishing methods	:	Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. In the event of fire and/or explosion do not breathe fumes.

Section: 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Ensure adequate ventilation. Keep people away from and upwind of spill/leak. Avoid inhalation, ingestion and contact with skin and eyes. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Ensure clean-up is conducted by trained personnel only. Refer to protective measures listed in sections 7 and 8.
Environmental precautions	:	Do not allow contact with soil, surface or ground water.
Methods and materials for containment and cleaning up	:	Stop leak if safe to do so. Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). Flush away traces with water. For large spills, dike spilled material or otherwise contain material to ensure runoff does not reach a waterway.

Section: 7. HANDLING AND STORAGE

Advice on safe handling	:	Do not ingest. Do not breathe dust/fume/gas/mist/vapours/spray. Do not get in eyes, on skin, or on clothing. Wash hands thoroughly after handling. Use only with adequate ventilation. Do not mix with bleach or other chlorinated products – will cause chlorine gas.
Conditions for safe storage	:	Keep away from strong bases. Keep out of reach of children. Keep container tightly closed. Store in suitable labeled containers.
Suitable material	:	Keep in properly labelled containers.
Unsuitable material	:	The following compatibility data is suggested based on similar product data and/or industry experience: Product is corrosive to aluminum. Aluminum should not be used for feed, storage, or transportation systems.

Section: 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures	:	Effective exhaust ventilation system. Maintain air concentrations below occupational exposure standards.

Personal protective equipment

Eye protection	:	Safety goggles Face-shield

Hand protection	:	Wear the following personal protective equipment: Standard glove type. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.
Skin protection	:	Personal protective equipment comprising: suitable protective gloves, safety goggles and protective clothing
Respiratory protection	:	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
Hygiene measures	:	Handle in accordance with good industrial hygiene and safety practice. Remove and wash contaminated clothing before re-use. Wash face, hands and any exposed skin thoroughly after handling. Provide suitable facilities for quick drenching or flushing of the eyes and body in case of contact or splash hazard.

Section: 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Liquid
Colour	:	clear
Odour	:	odourless
Flash point	:	> 93.3 °C Method: ASTM D 56, Tag closed cup
pH	:	< 1, 100 %
Odour Threshold	:	no data available
Melting point/freezing point	:	no data available
Initial boiling point and boiling range	:	> 100 °C
Evaporation rate	:	similar to water
Flammability (solid, gas)	:	no data available
Upper explosion limit	:	no data available
Lower explosion limit	:	no data available
Vapour pressure	:	similar to water
Relative vapour density	:	no data available
Relative density	:	1.267
Density	:	10.6 lb/gal
Water solubility	:	completely soluble
Solubility in other solvents	:	no data available
Partition coefficient: n-octanol/water	:	no data available
Auto-ignition temperature	:	no data available

Thermal decomposition temperature	:	no data available
Viscosity, dynamic	:	no data available
Viscosity, kinematic	:	no data available
Molecular weight	:	no data available
VOC	:	no data available

Section: 10. STABILITY AND REACTIVITY

Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	No dangerous reaction known under conditions of normal use.
Conditions to avoid	:	Freezing temperatures. Extremes of temperature
Incompatible materials	:	Contact with strong alkalies (e.g. ammonia and its solutions, carbonates, sodium hydroxide (caustic), potassium hydroxide, calcium hydroxide (lime), cyanide, sulfide, hypochlorites, chlorites) may generate heat, splattering or boiling and toxic vapors. Contact with reactive metals (e.g. aluminum) may result in the generation of flammable hydrogen gas. Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.
Hazardous decomposition products	:	Oxides of carbon Oxides of phosphorus

Section: 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure	:	Inhalation, Eye contact, Skin contact

Potential Health Effects

Eyes	:	Causes serious eye damage.
Skin	:	Causes severe skin burns.
Ingestion	:	Causes digestive tract burns.
Inhalation	:	May cause nose, throat, and lung irritation.
Chronic Exposure	:	Health injuries are not known or expected under normal use.

Experience with human exposure

Eye contact	:	Redness, Pain, Corrosion
Skin contact	:	Redness, Pain, Corrosion

Ingestion	: Corrosion, Abdominal pain
Inhalation	: Respiratory irritation, Cough

Toxicity

Product

Acute oral toxicity	: Acute toxicity estimate : > 5,000 mg/kg
Acute inhalation toxicity	: no data available
Acute dermal toxicity	: no data available
Skin corrosion/irritation	: no data available
Serious eye damage/eye irritation	: no data available
Respiratory or skin sensitization	: no data available
Carcinogenicity	: no data available
Reproductive effects	: no data available
Germ cell mutagenicity	: no data available
Teratogenicity	: no data available
STOT - single exposure	: no data available
STOT - repeated exposure	: no data available
Aspiration toxicity	: no data available

Components

Acute dermal toxicity	: Hydroxyethylidenediphosphonic Acid LD50 rabbit: > 10,000 mg/kg

Section: 12. ECOLOGICAL INFORMATION

Ecotoxicity

Environmental Effects	: This product has no known ecotoxicological effects.

Product

Toxicity to fish	: LC50 Pimephales promelas (fathead minnow): 1,098 mg/l Exposure time: 96 hrs Test substance: Product

LC50 Oncorhynchus mykiss (rainbow trout): 1,146 mg/l
Exposure time: 96 hrs
Test substance: Product

NOEC Pimephales promelas (fathead minnow): 625 mg/l
Exposure time: 96 hrs
Test substance: Product

NOEC Oncorhynchus mykiss (rainbow trout): 625 mg/l
Exposure time: 96 hrs
Test substance: Product

Toxicity to daphnia and other aquatic invertebrates : EC50 Daphnia magna (Water flea): 682 mg/l
Exposure time: 48 hrs
Test substance: Product

NOEC Daphnia magna (Water flea): 313 mg/l
Exposure time: 48 hrs
Test substance: Product

Persistence and degradability

no data available

Mobility

no data available

Bioaccumulative potential

no data available

Other information

no data available

Section: 13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it could meet the criteria of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Before disposal, it should be determined if the waste meets the criteria of a hazardous waste.

Hazardous Waste: : D002

Disposal methods : Where possible recycling is preferred to disposal or incineration. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of wastes in an approved waste disposal facility.

Disposal considerations : Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.

Section: 14. TRANSPORT INFORMATION

The shipper/consignor/sender is responsible to ensure that the packaging, labeling, and markings are in compliance with the selected mode of transport.

Land transport (DOT)

Proper shipping name	:	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical name(s)	:	HYDROXYETHYLIDENE DIPHOSPHONIC ACID
UN/ID No.	:	UN 3265
Transport hazard class(es)	:	8
Packing group	:	III

Air transport (IATA)

Proper shipping name	:	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical name(s)	:	HYDROXYETHYLIDENE DIPHOSPHONIC ACID
UN/ID No.	:	UN 3265
Transport hazard class(es)	:	8
Packing group	:	III

Sea transport (IMDG/IMO)

Proper shipping name	:	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical name(s)	:	HYDROXYETHYLIDENE DIPHOSPHONIC ACID
UN/ID No.	:	UN 3265
Transport hazard class(es)	:	8
Packing group	:	III

Section: 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know Act

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 311/312 Hazards	:	Acute Health Hazard
SARA 302	:	No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.
SARA 313	:	This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Prop 65

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

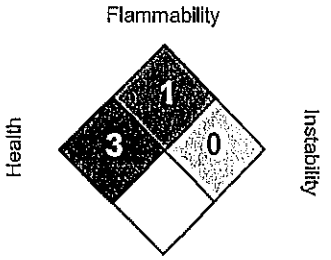
INTERNATIONAL CHEMICAL CONTROL LAWS :

TOXIC SUBSTANCES CONTROL ACT (TSCA)
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

Section: 16. OTHER INFORMATION

NFPA:



HMIS III:

HEALTH	3
FLAMMABILITY	1
PHYSICAL HAZARD	0

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Revision Date	:	10/15/2015
Version Number	:	1.1
Prepared By	:	Regulatory Affairs

REVISED INFORMATION: Significant changes to regulatory or health information for this revision is indicated by a bar in the left-hand margin of the SDS.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
For additional copies of an SDS visit www.nalco.com and request access.

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Once-Through Cooling Chemical Additives

- Manufacturers Product Identification Number: **Acti-Brom 1318 (Sodium Bromide)**
- Product Use: **Biocide**
- Chemical Composition: **NaBr**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Intermittent use; not exceeding 2 hours/unit/day**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Detectable**
- Outfall: **001**

NALCO

SAFETY DATA SHEET

PRODUCT

ACTI-BROM® 1318

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : **ACTI-BROM® 1318**

APPLICATION : BIOCIDE

COMPANY IDENTIFICATION : Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 1 / 1 FLAMMABILITY : 0 / 0 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
Sodium Bromide	7647-15-6	30.0 - 60.0

3. HAZARDS IDENTIFICATION

****EMERGENCY OVERVIEW****

CAUTION
Causes moderate eye irritation.
Avoid contact with eyes, skin and clothing. Wash with soap and water after handling. Remove contaminated clothing and wash before reuse.
May evolve hydrogen bromide and bromine under fire conditions.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
Can cause mild to moderate irritation.

SKIN CONTACT :
May cause irritation with prolonged contact.

INGESTION :
Not a likely route of exposure. There may be irritation to the gastro-intestinal tract with nausea and vomiting.

INHALATION :
Not a likely route of exposure. Repeated or prolonged exposure may irritate the respiratory tract.

AGGRAVATION OF EXISTING CONDITIONS :
A review of available data does not identify any worsening of existing conditions.

HUMAN HEALTH HAZARDS - CHRONIC :
No adverse effects expected other than those mentioned above.

4. FIRST AID MEASURES

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

IF SWALLOWED: Call poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.

IF INHALED: Remove victim to fresh air. If not breathing, give artificial respiration, preferably, mouth-to-mouth. Get medical attention.^

5. FIRE FIGHTING MEASURES

FLASH POINT : None

EXTINGUISHING MEDIA :
Not expected to burn. Keep containers cool by spraying with water. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD :
May evolve hydrogen bromide and bromine under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Keep people away from and upwind of spill/leak. Ventilate spill area if possible. Ensure clean-up is conducted by

trained personnel only. Do not touch spilled material. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Wash site of spillage thoroughly with water. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
This pesticide is toxic to fish and aquatic organisms. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters, unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

7. HANDLING AND STORAGE

HANDLING :
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Do not breathe vapors/gases/dust. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled.

STORAGE CONDITIONS :
Store the containers tightly closed. Store in suitable labeled containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
This product does not contain any substance that has an established exposure limit.

ENGINEERING MEASURES :
General ventilation is recommended.

RESPIRATORY PROTECTION :
Respiratory protection is not normally needed. Where concentrations in air may exceed the limits given in this section or when significant mists, vapors, aerosols, or dusts are generated, an approved air purifying respirator equipped with suitable filter cartridges is recommended. Consult the respirator / cartridge manufacturer data to verify the suitability of specific devices. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
When handling this product, the use of chemical gloves is recommended. The choice of work glove depends on work conditions and what chemicals are handled. Please contact the PPE manufacturer for advice on what type of glove material may be suitable. Gloves should be replaced immediately if signs of degradation are observed.

SKIN PROTECTION :
Wear standard protective clothing.

EYE PROTECTION :
Wear chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

HUMAN EXPOSURE CHARACTERIZATION :
Based on our recommended product application and personal protective equipment, the potential human exposure is: Moderate

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Colorless
ODOR	None

SPECIFIC GRAVITY	1.45 @ 77 °F / 25 °C
DENSITY	12.1 lb/gal
SOLUBILITY IN WATER	Complete
pH (100 %)	7.9
VISCOSITY	5 cps
FREEZING POINT	7 °F / -14 °C
BOILING POINT	218 °F / 103.5 °C
VAPOR PRESSURE	5.6 mm Hg @ 68 °F / 20 °C
VOC CONTENT	0.00 %

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Freezing temperatures.

MATERIALS TO AVOID :
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: None known

11. TOXICOLOGICAL INFORMATION

The following results are for a similar product.

ACUTE ORAL TOXICITY :

Species:	Rat
LD50:	> 5,000 mg/kg
Test Descriptor:	Similar Product

ACUTE DERMAL TOXICITY :

Species:	Rabbit
LD50:	> 2,000 mg/kg
Test Descriptor:	Similar Product

PRIMARY SKIN IRRITATION :

Species:	Rabbit
Draize Score:	0.0 /8.0
Test Descriptor:	Similar Product

PRIMARY EYE IRRITATION :

Species:	Rabbit
Draize Score:	16.0 /110.0
Test Descriptor:	Similar Product

SENSITIZATION :
This product is not expected to be a sensitizer.

CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: Low

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the product and a similar product. The following results are for the active components. The following results are for the hypobromous acid (as Br2) generated from sodium bromide and hypochlorite.

Acute Fish Results :

Species	Exposure	Test Type	Value	Test Descriptor
Bluegill Sunfish	96 hrs	LC50	0.52 mg/l	HOBr (Generated from NaBr)
Rainbow Trout	96 hrs	LC50	0.23 mg/l	HOBr (Generated from NaBr)
Sheepshead Minnow	96 hrs	LC50	0.19 mg/l	HOBr (Generated from NaBr)
Bluegill Sunfish	96 hrs	LC50	> 1,000 mg/l	Similar Product
Rainbow Trout	96 hrs	LC50	> 1,000 mg/l	Similar Product
Fathead Minnow	96 hrs	LC50	0.097 mg/l	HOBr (Generated from NaBr)
Fathead Minnow	96 hrs	LC50	> 5,000 mg/l	Product

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Daphnia magna	48 hrs	LC50	0.038 mg/l	HOBr (Generated from NaBr)
American Oyster	96 hrs	LC50	0.54 mg/l	HOBr (Generated from NaBr)
Mysid Shrimp (Mysidopsis bahia)	96 hrs	LC50	0.17 mg/l	HOBr (Generated from NaBr)
Daphnia magna	48 hrs	LC50	7,900 mg/l	Active Substance (Sodium Bromide)
Ceriodaphnia dubia	48 hrs	LC50	> 5,000 mg/l	Product

ADDITIONAL ECOLOGICAL DATA
AOX information: Product contains no organic halogens.

PERSISTENCY AND DEGRADATION :

Biological Oxygen Demand (BOD) : This material is an oxidizing biocide and is not expected to persist in the environment.

Greater than 95% of this product consists of inorganic substances for which a biodegradation value is not applicable.

MOBILITY :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	30 - 50%	50 - 70%

The portion in water is expected to be soluble or dispersible.

BIOACCUMULATION POTENTIAL
This preparation or material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low
Based on our recommended product application and the product's characteristics, the potential environmental exposure is: Moderate

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous waste, it is not subject to federal regulation. Consult state or local regulation for any additional handling, treatment or disposal requirements. For disposal, contact a properly licensed waste treatment, storage, disposal or recycling facility.

DO NOT REUSE EMPTY CONTAINER. Triple rinse the container (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incinerate. Burn only if allowed by state and local authorities. If burned, stay out of smoke.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

Sodium Bromide : Non-Hazardous

CERCLA/SUPERFUND, 40 CFR 302 :
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
-	Delayed (Chronic) Health Hazard
-	Fire Hazard
-	Sudden Release of Pressure Hazard
-	Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
This product is exempted under TSCA and regulated under FIFRA. The inerts are on the Inventory List.

FOOD AND DRUG ADMINISTRATION (FDA) Federal Food, Drug and Cosmetic Act :
When use situations necessitate compliance with FDA regulations, this product is acceptable under : 21 CFR 173.315 chemicals used in washing or to assist in the lye peeling of fruits and vegetables, 21 CFR 176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods., 21 CFR 176.300 Slimicides, The following limitations apply:

This product may be used to treat pulp and papermill water systems in situations requiring FDA sanction provided the bromide concentration in the water is kept below 22 ppm. The product must be used in conjunction with an oxidant such as bleach or gaseous chlorine. Follow instructions for use in pulp and papermill on the product label.

NSF NON-FOOD COMPOUNDS REGISTRATION PROGRAM (former USDA List of Proprietary Substances & Non-Food Compounds) :
NSF Registration number for this product is : 145774
This product is acceptable for treatment of cooling and retort water (G5) in and around food processing areas. This product is acceptable for treating boilers, steam lines, and/or cooling systems (G7) where neither the treated water nor the steam produced may contact edible products in and around food processing areas.

FEDERAL INSECTICIDE, FUNGICIDE AND RODENTICIDE ACT (FIFRA) :
EPA Reg. No. 5185-467-1706

In all cases follow instructions on the product label.

This product has been certified as KOSHER/PAREVE for year-round use INCLUDING THE PASSOVER SEASON by the CHICAGO RABBINICAL COUNCIL.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CLEAN AIR ACT, Sec. 112 (Hazardous Air Pollutants, as amended by 40 CFR 63), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CALIFORNIA PROPOSITION 65 :
Substances listed under California Proposition 65 are not intentionally added or expected to be present in this product.

MICHIGAN CRITICAL MATERIALS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

STATE RIGHT TO KNOW LAWS :
This product is a registered biocide and is exempt from State Right to Know Labelling Laws.

INTERNATIONAL CHEMICAL CONTROL LAWS :

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: Low

* The environmental risk is: Low

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),
Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight™ (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date issued : 03/26/2012
Version Number : 1.22

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Once-Through Cooling Chemical Additives

- Manufacturers Product Identification Number: **Ammonia**
- Product Use: **Biocide (oxidizing)**
- Chemical Composition: **NH3**
- Classification (non-persistent, persistent or bioaccumulative): **Believed Non-persistent**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Intermittent use; not exceeding 2 hours/day/unit**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Detectable**
- Outfall: **001**

Section 1. Identification

GHS product identifier : OXAMINE 6150

Other means of identification : Biocides

Product type : Liquid.

Relevant identified uses of the substance or mixture and uses advised against

See label and/or technical data sheet, if available.

Supplier's details : Buckman Laboratories, Inc.
1256 North McLean Boulevard
Memphis, TN 38108
Phone 1-800-282-5626

Emergency telephone number (with hours of operation) : 24 Hour Emergency Phone (901) 767-2722

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : ACUTE TOXICITY (inhalation) - Category 4
SKIN IRRITATION - Category 2
EYE IRRITATION - Category 2B

GHS label elements

Hazard pictograms :

Signal word : Warning

Hazard statements : Harmful if inhaled.
Causes skin and eye irritation.

Precautionary statements

Prevention : Wear protective gloves. Use only outdoors or in a well-ventilated area. Avoid breathing vapor. Wash hands thoroughly after handling.

Response : IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Not applicable.

Disposal : Not applicable.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Other means of identification : Biocides

Product code : OXM6150

Ingredient name	%	CAS number
Ammonia	<8	7664-41-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

While some substances are claimed as trade secret in accordance with the provision of OSHA 29 CFR 1910.1200(i), all known hazards are clearly communicated within this document.

Per Appendix D 1910.1200 OSHA, ranges can be used when there is batch-to-batch variability in a mixture or a trade secret claim.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact :
- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for further treatment advice.

Inhalation :
- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth if possible.
- Call a poison control center or doctor for further treatment advice.

Skin contact :
- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

Ingestion :
- Call poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water, if able to swallow.
- Do not induce vomiting unless told to do so by the poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

Notes to physician : Not available.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
nitrogen oxides

Section 5. Fire-fighting measures

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Satisfactory Materials of Construction : ABS Plastic
Aluminum 6063
Buna-N Rubber (Nitrile)
butyl rubber
C-Flex Tubing Clear
C-Flex Tubing White
Dow Silastic Tubing
EPDM rubber
MDPE
Fiberglass-Reinforced Plastic (FRP)
Hastaloy C-276 Alloy
Hypalon (CSPE)
Kynar
Norprene Tubing
Nylon 6-6
Perfluoroalkoxy (PFA)
PharMed Tubing
Polycarbonate
Polyethylene - Crosslinked (XLPE)
Polyethylene - High Density (HDPE)
Polyethylene - Terephthalate (PET)
Polyisoprene Latex Rubber (PIB)
Polypropylene (PP)
Polystyrene (PS)
Polyurethane (PUR)
PVC Chlorinated (CPVC)
PVC Flexible
PVC Rigid
REHAU Tubing (LDPE)
Silicone Rubber
Steel - 304 L Stainless
Steel - 316 L Stainless
Teflon
Tenite Plastic
Tygon R3400
Tygon R3603
Tygon R4040/F4040
Viton
NOTE: With respect to all other materials not listed above, user should be aware that use of such materials with this product may be hazardous and result in damages to such materials and other property and personal injuries. No data concerning such materials not listed above should be implied by the user.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Section 8. Exposure controls/personal protection

Ingredient name	Exposure limits
Ammonia	**ACGIH (United States).** TWA: 18 mg/m³ STEL: 27 mg/m³ TWA: 25 ppm STEL: 35 ppm **OSHA (United States).** TWA: 50 ppm TWA: 35 mg/m³ **ACGIH TLV (United States, 3/2016).** TWA: 25 ppm 8 hours. TWA: 17 mg/m³ 8 hours. STEL: 35 ppm 15 minutes. STEL: 24 mg/m³ 15 minutes. **OSHA PEL 1989 (United States, 3/1989).** STEL: 35 ppm 15 minutes. STEL: 27 mg/m³ 15 minutes. **OSHA PEL (United States, 2/2013).** TWA: 50 ppm 8 hours. TWA: 35 mg/m³ 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls/personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties

Appearance

Physical state	: Liquid.
Color	: Clear
Odor	: Ammoniacal. [Slight]
Odor threshold	: Not available.
pH	: 9.1 to 9.3
Melting point	: -6.7°C (19.9°F)
Boiling point	: 111°C (231.8°F)
Flash point	: Closed cup: >93.3°C (>199.9°F) [Pensky-Martens.]
Evaporation rate	: Not available.
Flammability (solid, gas)	: Not available.
Lower and upper explosive (flammable) limits	: Not available.
Vapor pressure	: Not available.
Vapor density	: Not available.
Relative density	: 1.15
Dispersibility properties	: Not available.
Solubility	: Soluble in the following materials: cold water and hot water.
Partition coefficient: n-octanol/water	: Not available.
Auto-ignition temperature	: Not available.
Decomposition temperature	: Not available.
Viscosity	: Not available.
VOC	: 0 % (w/w) [Method 24]

Aerosol product

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: No specific data.
Incompatible materials	: No specific data.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Ammonia	LC50 Inhalation Gas.	Rat	9500 ppm	1 hours
	LC50 Inhalation Gas.	Rat	2000 ppm	4 hours
OXAMINE 6150	LC50 Inhalation Dusts and mists	Rat	>2.08 mg/l	4 hours
	LD50 Dermal	Rabbit	>2000 mg/kg	-
	LD50 Oral	Rat - Female	>5000 mg/kg	-

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
OXAMINE 6150	Skin - Mild irritant	Rabbit	-	-	-
	Eyes - Mild irritant	Rabbit	-	-	-

Sensitization

Product/ingredient name	Route of exposure	Species	Result
OXAMINE 6150	skin	Guinea pig	Not sensitizing

Mutagenicity

Not available.

Carcinogenicity

This product has not been tested unless noted in summary results.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Routes of entry anticipated: Dermal, Inhalation.
Routes of entry not anticipated: Oral.

Potential acute health effects

Eye contact : Causes eye irritation.

Inhalation : Harmful if inhaled.

Skin contact : Causes skin irritation.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Section 11. Toxicological information

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
OXAMINE 6150	Acute EC50 >131 mg/l	Daphnia - *Daphnia magna*	48 hours
	Acute EC50 491 mg/l	Daphnia - *Daphnia pulex*	48 hours
	Acute LC50 259 mg/l	Fish	96 hours
	Acute LC50 >117 mg/l	Fish	96 hours
	Acute LC50 >126 mg/l	Fish	96 hours

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a

Section 13. Disposal considerations

safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	3266	3266	3266
UN proper shipping name	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (ammonia, anhydrous, solution) RQ (ammonia, anhydrous)	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (ammonia, anhydrous, solution). Marine pollutant (ammonia, anhydrous)	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (ammonia, anhydrous, solution)
Transport hazard class(es)	8 	8 	8 
Packing group	III	III	III
Environmental hazards	No.	Yes.	Yes. The environmentally hazardous substance mark is not required.
Additional information	**Reportable quantity** 1262.6 lbs / 573.23 kg [131.68 gal / 498.46 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Remarks** ERG Guide 154	The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg. **Emergency schedules (EmS)** F-A, S-B **IMDG Code Segregation group** 2 - Ammonium compounds **Remarks** ERG Guide 154, HazMat Code 4935258	The environmentally hazardous substance mark may appear if required by other transportation regulations. **Remarks** ERG Guide 154, ERG Code 8L

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

Potential impurities present in trace quantities are included in the regulatory listings of this section.

U.S. Federal regulations : **United States Inventory (TSCA 8b)**: This product is subject to regulation under the US Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and is therefore exempt from US Toxic Substances Control Act (TSCA) Inventory listing requirements.

Clean Water Act (CWA) 307: Nickel; chromium; mercury; Cyanide, solid

Clean Water Act (CWA) 311: ammonia, anhydrous

Clean Air Act (CAA) 112 regulated toxic substances: ammonia, anhydrous

SARA 302/304

Composition/information on ingredients

Name	%	EHS	SARA 302 TPQ		SARA 304 RQ	
			(lbs)	(gallons)	(lbs)	(gallons)
Ammonia	<8	Yes.	500	-	100	-

SARA 304 RQ : 1262.6 lbs / 573.2 kg [131.7 gal / 498.5 L]

SARA 311/312

Classification : Immediate (acute) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Ammonia	<8	Yes.	Yes.	No.	Yes.	No.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	Ammonia Mercury	7664-41-7 7439-97-6	<8 0.0000039
Supplier notification	Ammonia	7664-41-7	<8

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

Product contains up to approximately 8% aqueous ammonia which is subject to reporting under section 313 of the Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR § 372.

CERCLA : CERCLA: Hazardous substances.:
Ammonia, CAS# 7664-41-7, RQ = 100 pounds
Ammonium hydroxide, CAS# 1336-21-6, RQ = 1,000 pounds
Mercury, CAS# 7439-97-6, RQ = 1 pounds
Chromium, CAS# 7440-47-3, RQ = 5000 pounds
Nickel, CAS# 7440-02-0, RQ = 100 pounds
Cyanide, solid, CAS# 57-12-5, no RQ is being assigned to the generic or broad class

FDA : This product is allowed under the following FDA (21 CFR) sections :176.170.

BfR : XXXVI

EPA Reg. No. : 1448-433

Section 15. Regulatory information

FIFRA : This chemical is a pesticide product registered by the United States Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS), and for workplace labels of non-pesticide chemicals. The hazard information required on the pesticide label is reproduced below. The pesticide label also includes other important information, including directions for use.

CAUTION: Harmful if swallowed. Avoid breathing vapor. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing before reuse.

ENVIRONMENTAL HAZARDS: The pesticide is toxic to fish and aquatic organisms. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

State regulations

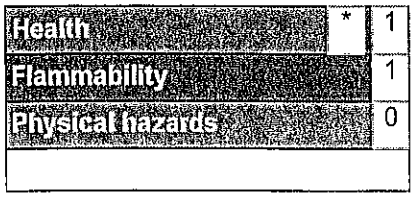
California Prop. 65

WARNING: This product contains less than 0.1% of a chemical known to the State of California to cause cancer.
WARNING: This product contains less than 1% of a chemical known to the State of California to cause birth defects or other reproductive harm.

Ingredient name	Cancer	Reproductive
Nickel	Yes.	No.
mercury	No.	Yes.
Cyanide, solid	No.	Yes.

Section 16. Other information

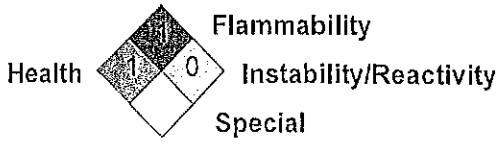
Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



Section 16. Other information

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History

Date of printing	:	9/16/2016
Date of issue/Date of revision	:	9/16/2016
Date of previous issue	:	8/25/2016
Version	:	3.07
Prepared by	:	Buckman Regulatory Affairs
Key to abbreviations	:	ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Buckman Laboratories, Inc. warrants that this product conforms to its chemical description and is reasonably fit for the purpose referred to in the directions for use when used in accordance with the directions under normal conditions. Buyer assumes the risk of any use outside of such directions.

Seller makes no other warranty or representation of any kind, express or implied, concerning the product, including NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS OF THE GOODS FOR ANY OTHER PARTICULAR PURPOSE. No such warranties shall be implied by law and no agent of seller is authorized to alter this warranty in any way except in writing with a specific reference to this warranty.
The exclusive remedy against seller shall be in a claim for damages not to exceed the purchase price of the product, without regard to whether such a claim is based upon breach of warranty or tort.

Any controversy or claim arising out or relating to this contract, or breach thereof, shall be settle by arbitration in accordance with the commercial arbitration rules of the American Arbitration Association, and judgment upon the rendered by the Arbitrator(s) may be entered in any court having jurisdiction thereof.

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Once-Through Cooling Chemical Additives

- Manufacturers Product Identification Number: **ChemTreat CL4075A**
- Product Use: **Corrosion inhibitor**
- Chemical Composition: **1-Hydroxyethylidene-1,1-diphosphonic acid**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Intermittent use as needed**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Detectable**
- Outfall: **001**

SAFETY DATA SHEET

Section 1. Chemical Product and Company Identification

Product Name:	ChemTreat CL4075A
Product Use:	Cooling Water Treatment
Supplier's Name:	ChemTreat, Inc.
Emergency Telephone Number:	(800)424-9300 (Toll Free)
Address (Corporate Headquarters):	5640 Cox Road Glen Allen, VA 23060
Telephone Number for Information:	(800)648-4579
Date of SDS:	May 9, 2016
Revision Date:	May 9, 2016
Revision Number:	16050901AN

Section 2. Hazard(s) Identification

Signal Word: DANGER

GHS Classification(s):

Skin corrosion/irritation – Category 1b
Eye damage/irritation – Category 1
Acute Toxicity Dermal – Category 4
Acute Toxicity Inhalation – Category 4
Acute Toxicity Oral – Category 4

Hazard Statement(s):

H314 Causes severe skin burns and eye damage.
H318 Causes serious eye damage.
H312 Harmful in contact with skin.
H332 Harmful if inhaled.
H302 Harmful if swallowed.

Precautionary Statement(s):

Prevention:

P260 Do not breathe dust/fume/gas/mist/vapors/spray.
P264 Wash thoroughly after handling.
P270 Do not eat, drink, or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

Response:	P301 + P312 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell P301 + 330 + 331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. P303 + P361 + P353 IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower P304 + P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing P305 + P351 + P388 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P310 Immediately call a POISON CENTER/doctor. P363 Wash contaminated clothing before reuse.
Storage:	P405 Store locked up.
Disposal:	P501 Dispose of contents and container in accordance with applicable local, regional, national, and/or international regulations.

System of Classification Used: Classification under 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Hazards Not Otherwise Classified: None.

Section 3. Composition/Hazardous Ingredients

Component	CAS Registry #	Wt.%
1-Hydroxyethylidene-1,1-diphosphonic acid	2809-21-4	10 - 30

Comments If chemical identity and/or exact percentage of composition has been withheld, this information is considered to be a trade secret.

Section 4. First Aid Measures

Inhalation: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a poison center or doctor/physician.

Eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center or doctor/physician.

Skin:	Immediately remove/take off all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before re-use. Immediately call a poison center or doctor/physician.
Ingestion:	DO NOT INDUCE VOMITING. Rinse mouth. Call a POISON CENTER or doctor/physician.
Most Important Symptoms:	N/D
Indication of Immediate Medical Attention and Special Treatment Needed, If Necessary:	N/A

Section 5. Fire Fighting Measures

Flammability of the Product:	Not flammable.
Suitable Extinguishing Media:	Use extinguishing media suitable to surrounding fire.
Specific Hazards Arising from the Chemical:	Use water spray to keep containers cool.
Protective Equipment:	If product is involved in a fire, wear full protective clothing including a positive-pressure, NIOSH approved, self-contained breathing apparatus.

Section 6. Accidental Release Measures

Personal Precautions:	Use appropriate Personal Protective Equipment (PPE).
Environmental Precautions:	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains, and sewers.
Methods for Cleaning up:	Contain and recover liquid when possible. Flush spill area with water spray.
Other Statements:	None.

Section 7. Handling and Storage

Handling: Wear appropriate Personal Protective Equipment (PPE) when handling this product. Do not get in eyes, or on skin and clothing. Wash thoroughly after handling. Do not ingest. Avoid breathing vapors, mist or dust.

Storage: Store away from incompatible materials (see Section 10). Store at ambient temperatures. Keep container securely closed when not in use. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. For Industrial use only.
Store above Freeze Point.

Section 8. Exposure Controls/Personal Protection

Exposure Limits

Component	Source	Exposure Limits
1-Hydroxyethylidene-1,1-diphosphonic acid	N/E	N/E

Engineering Controls: Use only with adequate ventilation. The use of local ventilation is recommended to control emission near the source.

Personal Protection

Eyes: Wear chemical splash goggles or safety glasses with full-face shield. Maintain eyewash fountain in work area.

Skin: Maintain quick-drench facilities in work area.
Wear butyl rubber or neoprene gloves. Wash them after each use and replace as necessary. If conditions warrant, wear protective clothing such as boots, aprons, and coveralls to prevent skin contact.

Respiratory: If misting occurs, use NIOSH approved organic vapor/acid gas dual cartridge respirator with a dust/mist prefilter in accordance with 29 CFR 1910.134.

Section 9. Physical and Chemical Properties

Physical State and Appearance:	Liquid, Colorless, Clear
Specific Gravity:	1.157 @ 20°C
pH:	0.5 @ 20°C, 100.0%
Freezing Point:	30°F
Flash Point:	N/D
Odor:	Mild
Melting Point:	N/A
Initial Boiling Point and Boiling Range:	212°F
Solubility in Water:	Soluble
Evaporation Rate:	<1
Vapor Density:	N/D
Molecular Weight:	N/D
Viscosity:	N/A
Flammability (solid, gas):	N/D
Flammable Limits:	N/A
Autoignition Temperature:	N/A
Density:	9.65 LB/GA
Vapor Pressure:	<17.5
% VOC:	N/D
Odor Threshold	N/D
n-octanol Partition Coefficient	N/D
Decomposition Temperature	N/D

Section 10. Stability and Reactivity

Chemical Stability:	Stable at normal temperatures and pressures.
Incompatibility with Various Substances:	Strong oxidizers, Bases.
Hazardous Decomposition Products:	Oxides of carbon, Oxides of phosphorus.
Possibility of Hazardous Reactions:	None known.
Reactivity:	N/D
Conditions To Avoid:	N/D

Section 11. Toxicological Information

Acute Toxicity

Chemical Name	Exposure	Type of Effect	Concentration	Species
1-Hydroxyethylidene-1,1-diphosphonic acid	Oral	LD50	2400 MG/KG	Rat
	Dermal	LD50	7940 MG/KG	Rabbit

Carcinogenicity Category

Component	Source	Code	Brief Description
1-Hydroxyethylidene-1,1-diphosphonic acid	N/E	N/E	N/E

Likely Routes of Exposure: N/D

Symptoms

Inhalation: N/D

Eye Contact: N/D

Skin Contact: N/D

Ingestion: N/D

Skin Corrosion/Irritation: N/D

Serious Eye Damage/Eye Irritation: N/D

Sensitization: N/D

Germ Cell Mutagenicity: N/D

Reproductive/Developmental Toxicity: N/D

Specific Target Organ Toxicity

Single Exposure: N/D

Repeated Exposure: N/D

Aspiration Hazard: N/D

Comments: None.

Section 12. Ecological Information

Ecotoxicity

Species	Duration	Type of Effect	Test Results
Daphnia magna	48h	EC50	1265 mg/l
Rainbow Trout	96h	LC50	>883 mg/l

Persistence and Biodegradability: N/D

Bioaccumulative Potential: N/D

Mobility In Soil: N/D

Other Adverse Effects: N/D

Comments: None.

Section 13. Disposal Considerations

Dispose of in accordance with local, state and federal regulations.
EPA corrosivity characteristic hazardous waste D002 when disposed of in the original product form.

Section 14. Transport Information

Controlling Regulation	UN/NA#:	Proper Shipping Name:	Technical Name:	Hazard Class:	Packing Group:
DOT	UN3265	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.	(1-HYDROXYETHYLIDENE-1, 1-DIPHOSPHONIC ACID)	8	PGIII

Note: N/A

Section 15. Regulatory Information

Inventory Status

United States (TSCA):	All ingredients listed.
Canada (DSL/NDSL):	All ingredients listed.

Federal Regulations

SARA Title III Rules

Sections 311/312 Hazard Classes

Fire Hazard:	No
Reactive Hazard:	No
Release of Pressure:	No
Acute Health Hazard:	Yes
Chronic Health Hazard:	No

Other Sections

Component	Section 313 Toxic Chemical	Section 302 EHS TPQ	CERCLA RQ
1-Hydroxyethylidene-1,1-diphosphonic acid	N/A	N/A	N/A

Comments: None.

State Regulations

California Proposition 65: None known.

Special Regulations

Component	States
1-Hydroxyethylidene-1,1-diphosphonic acid	None.

International Regulations

Canada

WHMIS Classification:	D2B (Toxic Material) E (Corrosive Material)
Controlled Product Regulations (CPR):	This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

Compliance Information

NSF:	N/A
Food Regulations:	N/A
KOSHER:	This product has not been evaluated for Kosher approval.
FIFRA:	N/A
Other:	None

Comments: None.

Section 16. Other Information

HMIS Hazard Rating

Health:	2
Flammability:	0
Physical Hazard:	1
PPE:	X

Notes: The PPE rating depends on circumstances of use. See Section 8 for recommended PPE.
The Hazardous Material Information System (HMIS) is a voluntary, subjective alpha-numeric symbolic system for recommending hazard risk and personal protection equipment information. It is a subjective rating system based on the evaluator's understanding of the chemical associated risks. The end-user must determine if the code is appropriate for their use.

Abbreviations

Abbreviation	Definition
<	Less Than
>	Greater Than
ACGIH	American Conference of Governmental Industrial Hygienists
EHS	Environmental Health and Safety Dept
N/A	Not Applicable
N/D	Not Determined
N/E	Not Established
OSHA	Occupational Health and Safety Dept
PEL	Personal Exposure Limit
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
TWA	Time Weight Average
UNK	Unknown

Prepared by: Product Compliance Department; ProductCompliance@chemtreat.com

Revision Date: May 9, 2016

Disclaimer

Although the information and recommendations set forth herein (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, ChemTreat, Inc. makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will ChemTreat, Inc. be responsible for damages of any nature whatsoever resulting from the use or reliance upon information. No representation or warranties, either expressed or implied, of merchantability, fitness for a particular purpose, or of any other nature are made hereunder with respect to information or the product to which information refers.

Attachment I

Boiler Chemical Additivies

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Ammonium hydroxide**
- Product Use: **pH adjustment**
- Chemical Composition: **NH_4OH**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Continuous low-concentration feed during operation**
- Product toxicity data: **Not Available**
- Concentration of whole product or active ingredient in wastestream: **< 0.5 mg/L**
- Outfall: **101**

Section 1. Identification

GHS product identifier	: Aqua Ammonia (20-30%)
Other means of identification	: Aqua Ammonia, Ammonium Hydroxide
Product type	: Liquid.
Product use	: Synthetic/Analytical chemistry.
Synonym	: Aqua Ammonia, Ammonium Hydroxide
SDS #	: 001195
Supplier's details	: Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
24-hour telephone	: 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status	: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	: SKIN CORROSION - Category 1B SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3 AQUATIC HAZARD (ACUTE) - Category 1

GHS label elements

Hazard pictograms :

Signal word	: Danger
Hazard statements	: May displace oxygen and cause rapid suffocation. Causes severe skin burns and eye damage. May cause respiratory irritation. Very toxic to aquatic life.

Precautionary statements

General	: Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.
Prevention	: Wear protective gloves. Wear eye or face protection. Wear protective clothing. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Avoid breathing vapor. Wash hands thoroughly after handling.
Response	: Collect spillage. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or physician. IF SWALLOWED: Immediately call a POISON CENTER or physician. Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. Wash contaminated clothing before reuse. Immediately call a POISON CENTER or physician. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or physician.
Storage	: Store locked up.
Disposal	: Dispose of contents and container in accordance with all local, regional, national and international regulations.

Section 2. Hazards identification

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Other means of identification : Aqua Ammonia, Ammonium Hydroxide

Product code : 001195

Ingredient name	%	CAS number
Aqua Ammonia	100	1336-21-6
WATER	70 - 80	7732-18-5
ammonia	20 - 30	7664-41-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician.

Inhalation : Get medical attention immediately. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : May cause respiratory irritation.

Skin contact : Causes severe burns.

Section 4. First aid measures

Frostbite	: Try to warm up the frozen tissues and seek medical attention.
Ingestion	: No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact	: Adverse symptoms may include the following:, pain, watering, redness
Inhalation	: Adverse symptoms may include the following:, respiratory tract irritation, coughing
Skin contact	: Adverse symptoms may include the following:, pain or irritation, redness, blistering may occur
Ingestion	: Adverse symptoms may include the following:, stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician	: In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.
Specific treatments	: No specific treatment.
Protection of first-aiders	: No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media	: Use an extinguishing agent suitable for the surrounding fire.
Unsuitable extinguishing media	: None known.
Specific hazards arising from the chemical	: In a fire or if heated, a pressure increase will occur and the container may burst. This material is very toxic to aquatic life. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.
Hazardous thermal decomposition products	: Decomposition products may include the following materials: nitrogen oxides
Special protective actions for fire-fighters	: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
Special protective equipment for fire-fighters	: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel	: No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Do not breathe vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
For emergency responders	: If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".
Environmental precautions	: Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities. Collect spillage.

Section 6. Accidental release measures

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Avoid release to the environment. Do not ingest. Empty containers retain product residue and can be hazardous. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Do not reuse container. Do not breathe vapor or mist.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Aqua Ammonia WATER ammonia	None. None. **California PEL for Chemical Contaminants (*Table AC-1*) (United States).** PEL: 25 ppm 8 hours. STEL: 35 ppm 15 minutes. **ACGIH TLV (United States, 3/2017).** TWA: 25 ppm 8 hours. TWA: 17 mg/m³ 8 hours. STEL: 35 ppm 15 minutes. STEL: 24 mg/m³ 15 minutes. **OSHA PEL 1989 (United States, 3/1989).** STEL: 35 ppm 15 minutes. STEL: 27 mg/m³ 15 minutes. **NIOSH REL (United States, 10/2016).** TWA: 25 ppm 10 hours. TWA: 18 mg/m³ 10 hours.

	STEL: 35 ppm 15 minutes. STEL: 27 mg/m³ 15 minutes. **OSHA PEL (United States, 6/2016).** TWA: 50 ppm 8 hours. TWA: 35 mg/m³ 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles and/ or face shield. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid.

Color : Clear.

Odor : Pungent.

Odor threshold : 5 ppm

pH : Approx. 11.6 for 1 N Sol'n. in water

Melting point : -35°F (20% solution) to -115°F(30% solution)

Boiling point : Lowest known value: 38°C (100.4°F) (ammonia). Weighted average: 65.56°C (150°F)

Critical temperature : Not available.

Flash point : Not available.

Section 9. Physical and chemical properties

Evaporation rate	:	Not available.
Flammability (solid, gas)	:	Extremely flammable in the presence of the following materials or conditions: Oxidizing
Lower and upper explosive (flammable) limits	:	Lower: 16% Upper: 25%
Vapor pressure	:	3-10 PSI @ 16 ◦C
Vapor density	:	Vapor density 0.6 (Air = 1) (ammonia)
Specific Volume (ft ^{3}/lb)	:	20.79
Gas Density (lb/ft ^{3})	:	0.0481
Relative density	:	0.6
Solubility	:	Soluble in water. Soluble in alcohol and ether.
Solubility in water	:	Complete 540 g/l
Partition coefficient: n-octanol/water	:	Not available.
Auto-ignition temperature	:	651°C (1203.8°F)
Decomposition temperature	:	Not available.
Viscosity	:	Not available.
Flow time (ISO 2431)	:	Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Yellow Metals (brass & copper)

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Aqua Ammonia ammonia	LD50 Oral LC50 Inhalation Gas.	Rat Rat	350 mg/kg 7338 ppm	- 1 hours

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Aqua Ammonia	Eyes - Severe irritant	Rabbit	-	250 Micrograms	-
	Eyes - Severe irritant	Rabbit	-	0.5 minutes 1 milligrams	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
Aqua Ammonia	Category 3	Not applicable.	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : May cause respiratory irritation.

Skin contact : Causes severe burns.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:, pain, watering, redness

Inhalation : Adverse symptoms may include the following:, respiratory tract irritation, coughing

Skin contact : Adverse symptoms may include the following:, pain or irritation, redness, blistering may occur

Ingestion : Adverse symptoms may include the following:, stomach pains

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Section 11. Toxicological information

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
Aqua Ammonia ammonia	Acute LC50 37 ppm Fresh water Acute EC50 29.2 mg/l Marine water Acute LC50 2080 µg/l Fresh water Acute LC50 0.53 ppm Fresh water Acute LC50 300 µg/l Fresh water Chronic NOEC 0.204 mg/l Marine water	Fish - Gambusia affinis - Adult Algae - Ulva fasciata - Zoea Crustaceans - Gammarus pulex Daphnia - Daphnia magna Fish - Hypophthalmichthys nobilis Fish - Dicentrarchus labrax	96 hours 96 hours 48 hours 48 hours 96 hours 62 days

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
WATER	-1.38	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN2672	UN2672	UN2672	UN2672	UN2672
UN proper shipping name	Ammonium Hydroxide or Ammonia solutions	AMMONIA SOLUTION	AMMONIA SOLUTION	AMMONIA SOLUTION	Ammonia solution
Transport hazard class(es)	8 	8 	8 	8 	8 
Packing group	III	III	III	III	III
Environmental hazards	Yes.	Yes.	Yes. The environmentally hazardous substance mark is not required.	Yes.	Yes. The environmentally hazardous substance mark is not required.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : This product is not regulated as a marine pollutant when transported on inland waterways in sizes of ≤5 L or ≤5 kg or by road, rail, or inland air in non-bulk sizes, provided the packagings meet the general provisions of §§ 173.24 and 173.24a. **Reportable quantity** 1000 lbs / 454 kg [2493.4 gal / 9438.7 L]. Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.40-2.42 (Class 8), 2.7 (Marine pollutant mark). The marine pollutant mark is not required when transported by road or rail.

IMDG : The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg.

IATA : The environmentally hazardous substance mark may appear if required by other transportation regulations.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Water Act (CWA) 311: ammonia; ammonia

Clean Air Act (CAA) 112 regulated toxic substances: ammonia

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Section 15. Regulatory information

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

Name	%	EHS	SARA 302 TPQ		SARA 304 RQ	
			(lbs)	(gallons)	(lbs)	(gallons)
ammonia	20 - 30	Yes.	500	-	100	-

SARA 304 RQ : 333.3 lbs / 151.3 kg [831.1 gal / 3146.2 L]

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	ammonia ammonia	1336-21-6 7664-41-7	100 20 - 30
Supplier notification	ammonia ammonia	1336-21-6 7664-41-7	100 20 - 30

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : The following components are listed: AMMONIUM HYDROXIDE; AMMONIUM WATER; AMMONIA; AMMONIA, ANHYDROUS

New York : The following components are listed: Ammonium hydroxide; Ammonia

New Jersey : The following components are listed: AMMONIUM HYDROXIDE; AMMONIA

Pennsylvania : The following components are listed: AMMONIUM HYDROXIDE; AMMONIA

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : All components are listed or exempted.

Canada : All components are listed or exempted.

China : All components are listed or exempted.

Europe : All components are listed or exempted.

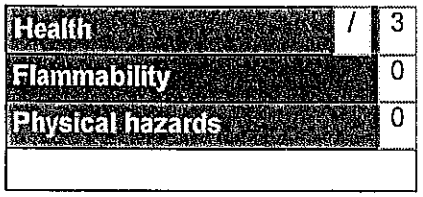
Japan : **Japan inventory (ENCS)**: All components are listed or exempted.
Japan inventory (ISHL): Not determined.

Section 15. Regulatory information

Malaysia	:	All components are listed or exempted.
New Zealand	:	All components are listed or exempted.
Philippines	:	All components are listed or exempted.
Republic of Korea	:	All components are listed or exempted.
Taiwan	:	All components are listed or exempted.
Thailand	:	Not determined.
Turkey	:	Not determined.
United States	:	All components are listed or exempted.
Viet Nam	:	Not determined.

Section 16. Other information

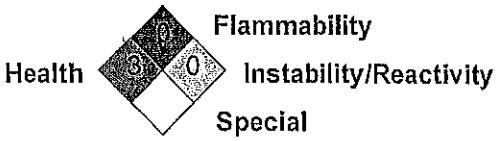
Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

National Fire Protection Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
SKIN CORROSION - Category 1B	Expert judgment
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3	Calculation method
AQUATIC HAZARD (ACUTE) - Category 1	Calculation method

History

Date of printing	:	2/15/2018
Date of issue/Date of revision	:	2/15/2018
Date of previous issue	:	2/15/2018
Version	:	0.09

Section 16. Other information

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Powerline 1320 (Morpholine)**
- Product Use: **pH adjustment**
- Chemical Composition: **C_4H_9NO**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Continuous low-concentration feed during operation**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

GE
Water & Process Technologies

Material Safety Data Sheet

Issue Date: 08-AUG-2008
Supercedes: 07-AUG-2008

POWERLINE 1320

1 Identification

Identification of substance or preparation
POWERLINE 1320

Product Application Area
Water based internal boiler treatment chemical.

Company/Undertaking Identification
GE Betz, Inc.
4636 Somerton Road
Trevose, PA 19053
T 215 355-3300, F 215 953 5524

Emergency Telephone
(800) 877-1940

Prepared by Product Stewardship Group: T 215-355-3300 Prepared on: 08-AUG-2008

2 Hazard(s) identification

****

EMERGENCY OVERVIEW

WARNING

May cause moderate irritation to the skin. Absorbed by skin. Severe irritant to the eyes, possibly corrosive. Vapors, gases, mists or aerosols may cause irritation to the upper respiratory tract. Prolonged exposure may cause dizziness and headache.

DOT hazard is not applicable
Odor: Strong; Appearance: Colorless, Liquid

Fire fighters should wear positive pressure self-contained breathing apparatus(full face-piece type). Proper fire-extinguishing media: dry chemical/CO2/foam or water--slippery condition; use sand/grit.

****

POTENTIAL HEALTH EFFECTS

ACUTE SKIN EFFECTS:
May cause moderate irritation to the skin. Absorbed by skin.

ACUTE EYE EFFECTS:
Severe irritant to the eyes, possibly corrosive.

ACUTE RESPIRATORY EFFECTS:
Primary route of exposure;Vapors, gases, mists or aerosols may

cause irritation to the upper respiratory tract. Prolonged exposure may cause dizziness and headache.

INGESTION EFFECTS:
May cause gastrointestinal irritation with possible nausea, vomiting, headache, dizziness, unconsciousness and injury to the kidneys and liver.

TARGET ORGANS:
Prolonged,or repeated exposures may cause toxicity to the liver and/or kidney.

MEDICAL CONDITIONS AGGRAVATED:
Not known.

SYMPTOMS OF EXPOSURE:
Vapors may cause irritation of eyes and/or respiratory tract leading to dizziness, drowsiness, headache and nausea. Skin contact may cause moderate irritation to burns, dependent on the length of exposure.

3 Composition / information on ingredients

Information for specific product ingredients as required by the U.S. OSHA HAZARD COMMUNICATION STANDARD is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

HAZARDOUS INGREDIENTS:

Cas#	Chemical Name	Range(w/w%)
110-91-8	MORPHOLINE Flammable liquid; corrosive; toxic (by skin absorption); potential liver and kidney toxin; IARC=3 (carcinogen status not classifiable); in vitro mutagen in laboratory animals	5-10

4 First-aid measures

SKIN CONTACT:
URGENT! Wash thoroughly with soap and water. Remove contaminated clothing. Get immediate medical attention. Thoroughly wash clothing before reuse.

EYE CONTACT:
URGENT! Immediately flush eyes with plenty of low-pressure water for at least 20 minutes while removing contact lenses. Hold eyelids apart. Get immediate medical attention.

INHALATION:
Remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get immediate medical attention.

INGESTION:
Do not feed anything by mouth to an unconscious or convulsive victim. Do not induce vomiting. Immediately contact physician.

Dilute contents of stomach using 2-8 fluid ounces (60-240 mL) of milk or water.

NOTES TO PHYSICIANS:

No special instructions

5 Fire-fighting measures

FIRE FIGHTING INSTRUCTIONS:

Fire fighters should wear positive pressure self-contained breathing apparatus (full face-piece type).

EXTINGUISHING MEDIA:

dry chemical/CO2/foam or water--slippery condition; use sand/grit.

HAZARDOUS DECOMPOSITION PRODUCTS:

oxides of carbon and nitrogen

FLASH POINT:

> 200F > 93C SETA(CC)

6 Accidental release measures

PROTECTION AND SPILL CONTAINMENT:

Ventilate area. Use specified protective equipment. Contain and absorb on absorbent material. Place in waste disposal container. Flush area with water. Wet area may be slippery. Spread sand/grit.

DISPOSAL INSTRUCTIONS:

Water contaminated with this product may be sent to a sanitary sewer treatment facility,in accordance with any local agreement,a permitted waste treatment facility or discharged under a permit. Product as is - Incinerate or land dispose in an approved landfill.

7 Handling and storage

HANDLING:

Vent carefully before opening.

STORAGE:

Keep containers closed when not in use. Do not freeze. If frozen, thaw and mix completely prior to use.

8 Exposure controls / personal protection

EXPOSURE LIMITS

CHEMICAL NAME

MORPHOLINE

PEL (OSHA): 20 PPM (30PPM-STEL)-SKIN

TLV (ACGIH): 20 PPM (30PPM-STEL)-SKIN-A4

ENGINEERING CONTROLS:

Adequate ventilation to maintain air contaminants below exposure limits.

PERSONAL PROTECTIVE EQUIPMENT:

Use protective equipment in accordance with 29CFR 1910 Subpart I

RESPIRATORY PROTECTION:

A RESPIRATORY PROTECTION PROGRAM THAT MEETS OSHA'S 29 CFR 1910.134 AND ANSI Z88.2 REQUIREMENTS MUST BE FOLLOWED WHENEVER WORKPLACE CONDITIONS WARRANT A RESPIRATOR'S USE.

USE AIR PURIFYING RESPIRATORS WITHIN USE LIMITATIONS ASSOCIATED WITH THE EQUIPMENT OR ELSE USE SUPPLIED AIR-RESPIRATORS.
If air-purifying respirator use is appropriate, use a respirator with organic vapor cartridges.

SKIN PROTECTION:

butyl gloves-- Wash off after each use. Replace as necessary.

EYE PROTECTION:

splash proof chemical goggles

9 Physical and chemical properties

Specific Grav.(70F,21C)	1.021	Vapor Pressure (mmHG)	~ 18.0
Freeze Point (F)	30	Vapor Density (air=1)	< 1.00
Freeze Point (C)	-1		
Viscosity(cps 70F,21C)	7	% Solubility (water)	100.0

Odor		Strong
Appearance		Colorless
Physical State		Liquid
Flash Point	SETA(CC)	> 200F > 93C
pH As Is (approx.)		10.0
Evaporation Rate (Ether=1)		< 1.00
Percent VOC:		5.0

NA = not applicable ND = not determined

10 Stability and reactivity

STABILITY:

Stable under normal storage conditions.

HAZARDOUS POLYMERIZATION:

Will not occur.

INCOMPATIBILITIES:

May react with strong oxidizers.

DECOMPOSITION PRODUCTS:

oxides of carbon and nitrogen

11 Toxicological information

Oral LD50 RAT:	>2,000 mg/kg
NOTE - Estimated value	
Dermal LD50 RABBIT:	>2,000 mg/kg
NOTE - Estimated value	

12 Ecological information

AQUATIC TOXICOLOGY

Daphnia magna 48 Hour Static Screen
0% Mortality= 1000 mg/L
Fathead Minnow 96 Hour Acute Toxicity (Estimated)
LC50= 1160; No Effect Level= 810 mg/L
Rainbow Trout 48 Hour Static Screen
0% Mortality= 1000 mg/L

BIODEGRADATION

BOD-28 (mg/g): 48
BOD-5 (mg/g): 0
COD (mg/g): 156
TOC (mg/g): 46

13 Disposal considerations

If this undiluted product is discarded as a waste, the US RCRA hazardous waste identification number is :
Not applicable.

Please be advised; however, that state and local requirements for waste disposal may be more restrictive or otherwise different from federal regulations. Consult state and local regulations regarding the proper disposal of this material.

14 Transport information

DOT HAZARD: Not Applicable
PROPER SHIPPING NAME:

DOT EMERGENCY RESPONSE GUIDE #: Not applicable
Note: Some containers may be DOT exempt, please check BOL for exact container classification

15 Regulatory information

TSCA:

All components of this product are included on or are in compliance with the U.S. TSCA regulations.

CERCLA AND/OR SARA REPORTABLE QUANTITY (RQ):

No regulated constituent present at OSHA thresholds

FOOD AND DRUG ADMINISTRATION:

All ingredients in this product are authorized in 21 CFR176.170 for use in boilers where the steam will be used for manufacturing paper or paperboard.

NSF Registered and/or meets USDA (according to 1998 Guidelines):

Registration number: Not Registered

SARA SECTION 312 HAZARD CLASS:

Immediate(acute);Delayed(Chronic)

SARA SECTION 302 CHEMICALS:

No regulated constituent present at OSHA thresholds

SARA SECTION 313 CHEMICALS:

No regulated constituent present at OSHA thresholds

CALIFORNIA REGULATORY INFORMATION

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):

No regulated constituents present

MICHIGAN REGULATORY INFORMATION

No regulated constituent present at OSHA thresholds

16 Other information

HMIS vII

CODE TRANSLATION

Health	2	Moderate Hazard
Fire	1	Slight Hazard
Reactivity	0	Minimal Hazard
Special	NONE	No special Hazard
(1) Protective Equipment	B	Goggles,Gloves

(1) refer to section 8 of MSDS for additional protective equipment recommendations.

CHANGE LOG

	EFFECTIVE DATE	REVISIONS TO SECTION:	SUPERCEDES
MSDS status:	22-AUG-1995	REVISED FORMAT	** NEW **
	09-AUG-1996	8,16	22-AUG-1995
	15-AUG-1996	;EDIT:9	09-AUG-1996
	04-JUN-1997	15	15-AUG-1996
	01-MAY-1998	;EDIT:9	04-JUN-1997
	27-OCT-1998	;EDIT:9	01-MAY-1998
	27-APR-2000	2	27-OCT-1998
	19-SEP-2002	4	27-APR-2000
	05-AUG-2008	4,5,8,10;EDIT:Rebrandi	19-SEP-2002
	06-AUG-2008	4,5,8,10;EDIT:Rebrandi	05-AUG-2008
	07-AUG-2008	4,5,8,10;EDIT:Rebrandi	06-AUG-2008
	08-AUG-2008	4,5,8,10;EDIT:Rebrandi	07-AUG-2008

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Cortrol OS5035 (Hydrazine)**
- Product Use: **Oxygen Scavenger**
- Chemical Composition: **N_2H_4**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Continuous low-concentration feed during operation**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

MSDS Material Safety Data Sheet

From: Avantor Performance Materials, Inc.
Saucon Valley Plaza
3477 Corporate Parkway
Suite #200
Center Valley, PA 18034

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response In Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service, 1-855-AVANTOR (855-282-6867) for assistance.

HYDRAZINE DIHYDROCHLORIDE

1. Product Identification

Synonyms: None
CAS No.: 5341-61-7
Molecular Weight: 104.98
Chemical Formula: H4N2.2HCL
Product Codes: N368

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrazine Dihydrochloride	5341-61-7	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT. EXPOSURE MAY CREATE CANCER RISK. MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. VAPORS CAUSE SEVERE IRRITATION TO EYES AND RESPIRATORY TRACT. MAY CAUSE ALLERGIC SKIN REACTION.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Cancer Causing)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 3 - Severe (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White Stripe (Store Separately)

Potential Health Effects

POISON. Exposure may create a cancer risk, based on animal testing. Information on the human health effects from exposure is limited.

Inhalation:
Harmful or fatal if inhaled. Vapors highly irritating to eyes and respiratory tract. Systemic poisoning may occur with symptoms similar to those of ingestion.
Ingestion:
Harmful or fatal if swallowed. Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea. May cause injury to lungs, liver and kidneys.
Skin Contact:
Corrosive. Symptoms of redness, pain, and severe burn can occur. May be harmful or fatal if absorbed through skin. Systemic poisoning may occur with symptoms similar to those of ingestion. May cause allergic skin reaction.
Eye Contact:
Corrosive. Can cause blurred vision, redness, pain, severe tissue burns and eye damage.
Chronic Exposure:
Exposure may cause damage to the liver, kidneys, and lungs. Carcinogenic potential based on animal tests with hydrazine.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard. Sealed containers may rupture when heated.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal.

7. Handling and Storage

Keep in a tightly closed container. Store in a cool, dry, corrosion-proof, ventilated area away from moisture, sources of heat or ignition, combustibles and oxidizers. Protect against physical damage. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- For Hydrazine (CAS 302-01-2) -
OSHA (PEL): 1 ppm (TWA), skin.
ACGIH (TLV): 0.01 ppm (TWA), skin, A3 - animal carcinogen.
NIOSH (REL): 0.03 ppm (2-hour), ceiling, potential occupational carcinogen.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134).
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
White crystalline powder.
Odor:
No information found.
Solubility:
Freely soluble.
Density:
1.420
pH:
No information found.

% Volatiles by volume @ 21C (70F):
0
Boiling Point:
200C (392F) Decomposes.
Melting Point:
198C (388F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Can decompose violently at elevated temperatures.
Hazardous Decomposition Products:
May produce carbon monoxide, carbon dioxide, nitrogen oxides and hydrogen chloride when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizing agents, strong bases, most common metals and organic materials.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:
No LD50/LC50 information found relating to normal routes of occupational exposure. Investigated as a mutagen.
Carcinogenicity:
For Hydrazine: NTP classification: Group 2 - Reasonably anticipated to be carcinogen.
IARC classification: Group 2B - Possibly carcinogenic to humans.
EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Hydrazine Dihydrochloride (5341-61-7)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: CORROSIVE SOLID, ACIDIC, INORGANIC, N.O.S. (HYDRAZINE DIHYDROCHLORIDE)
Hazard Class: 8
UN/NA: UN3260
Packing Group: III
Information reported for product/size: 500G

International (Water, I.M.O.)

Proper Shipping Name: CORROSIVE SOLID, ACIDIC, INORGANIC, N.O.S. (HYDRAZINE DIHYDROCHLORIDE)
Hazard Class: 8
UN/NA: UN3260
Packing Group: III
Information reported for product/size: 500G

International (Air, I.C.A.O.)

Proper Shipping Name: CORROSIVE SOLID, ACIDIC, INORGANIC, N.O.S. (HYDRAZINE DIHYDROCHLORIDE)
Hazard Class: 8
UN/NA: UN3260
Packing Group: III
Information reported for product/size: 500G

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Hydrazine Dihydrochloride (5341-61-7)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Hydrazine Dihydrochloride (5341-61-7)	No	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.

Ingredient				
Hydrazine Dihydrochloride (5341-61-7)	No	No	No	No

\Federal, State & International Regulations - Part 2\

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Hydrazine Dihydrochloride (5341-61-7)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **4** Flammability: **0** Reactivity: **2**
Label Hazard Warning:
DANGER! CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT. EXPOSURE MAY CREATE CANCER RISK. MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. VAPORS CAUSE SEVERE IRRITATION TO EYES AND RESPIRATORY TRACT. MAY CAUSE ALLERGIC SKIN REACTION.
Label Precautions:
Do not get in eyes, on skin, or on clothing. Do not breathe dust, mist or vapor. Keep container closed.
Use only with adequate ventilation. Wash thoroughly after handling.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases get medical attention immediately.
Product Use: Laboratory Reagent.
Revision Information: No Changes.

Disclaimer:
****
THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED "AS IS," AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION, WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE.
continued

THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

****

Prepared by: Environmental Health & Safety

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Sodium Hydroxide**
- Product Use: **pH adjustment**
- Chemical Composition: **NaOH**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Continuous low-concentration feed during operation**
- Product toxicity data: **Not Available**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

cP2451
R001809

MATERIAL SAFETY DATA SHEET

Vulcan CHEMICALS
A Division of Vulcan Materials Company
P O Box 530390
Birmingham, AL 35253-0390

24 Hour Emergency Phone 316/524-5751

SECTION 1 PRODUCT IDENTIFICATION

CHEMICAL NAME
Sodium Hydroxide Solution

CHEMICAL FORMULA
NaOH

MOLECULAR WEIGHT
40.00

PRODUCT NAME
Caustic Soda, 50% and Weaker Solutions

SYNONYMS
Liquid Caustic, Lye Solution, Caustic, Lye, Soda Lye

DOT IDENTIFICATION NO.
UN 1824

SECTION 2 COMPONENT DATA

CHEMICAL NAME	CAS NUMBER	% (wt.) Approx	OSHA PEL
Sodium Hydroxide	1310-73-2	50 and less	2 mg/m^3 Ceiling

Note: This Material Safety Data Sheet is also valid for caustic soda solutions weaker than 50%. The boiling point, vapor pressure, and specific gravity will be different from those listed.

SECTION 3 PHYSICAL DATA

APPEARANCE AND ODOR
Colorless or slightly colored, clear or opaque; odorless

SPECIFIC GRAVITY
50% Solution: 1.53 @ 60°F/60°F

BOILING POINT
50% Solution: 293°F (145°C)

VAPOR DENSITY IN AIR (Air = 1)
N/A

VAPOR PRESSURE
50% Solution: 6.3 mm Hg @ 104°F

% VOLATILE BY VOLUME
0

EVAPORATION RATE
0

SOLUBILITY IN WATER
100%

SECTION 4 REACTIVITY INFORMATION

STABILITY
Stable

CONDITIONS TO AVOID:
Mixture with water, acid or incompatible materials can cause splattering and release of large amounts of heat (Refer to Section 7). Will react with some metals forming flammable hydrogen gas.

INCOMPATIBLE MATERIALS
Chlorinated and fluorinated hydrocarbons (i.e. chloroform, difluoroethane), acetaldehyde, acrolein, aluminum, chlorine trifluoride, hydroquinone, maleic anhydride, phosphorous pentoxide and tetrahydrofuran.

HAZARDOUS DECOMPOSITION PRODUCTS
Will not decompose

HAZARDOUS POLYMERIZATION
Will not occur

SECTION 5 FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT
None

FLAMMABLE LIMITS IN AIR
None

EXTINGUISHING MEDIA
N/A

NFPA RATINGS
Health 3; Flammability 0; Reactivity 1

UNUSUAL FIRE AND EXPLOSION HAZARDS
Firefighters should wear self-contained positive pressure breathing apparatus, and avoid skin contact. Refer to Reactivity Data, Section 4.

SECTION 6 TOXICITY AND FIRST AID

EXPOSURE STANDARDS

ACGIH: 2 mg/m^3 Ceiling
OSHA 2 mg/m^3 Ceiling

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH:

IDLH: 250 mg/m^3

When exposure to this product and other chemicals is concurrent, the exposure limit must be defined in the workplace. Effects described in this section are believed not to occur if exposures are maintained at or below the appropriate ceiling limits, however because of the wide variation in individual susceptibility, these exposure limits may not be applicable to all persons and those with the medical conditions listed below.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
May aggravate existing skin and/or eye conditions on contact.

ACUTE TOXICITY

PRIMARY ROUTES OF EXPOSURE
Inhalation, skin and eye contact

INHALATION
Inhalation of solution mist can cause mild irritation at 2 mg/m^3. More severe burns and tissue damage in the upper respiratory tract can occur at higher concentrations. Pneumonitis can result from severe exposures.

SKIN
Major potential hazard - contact with the skin can cause severe burns with deep ulcerations. Contact with solution or mist can cause multiple burns with temporary loss of hair at burn site. Solutions of 4% may not cause irritation and burning for several hours, while 25% to 50% solutions can cause these effects in less than 3 minutes.

EYE
Major potential hazard - Liquid in the eye can cause severe eye tissue destruction and blindness. These effects can occur rapidly affecting all parts of the eye. Mist or dust can cause irritation, with high concentrations causing destructive burns.

INGESTION
Ingestion of sodium hydroxide can cause severe burning and pain in lips, mouth, tongue, throat and stomach. Severe scarring of the throat can occur after swallowing. Death can result from ingestion.

FIRST AID

INHALATION
Move person to fresh air. If breathing stops, administer artificial respiration. Get medical attention immediately.

SKIN

Remove contaminated clothing immediately and wash skin thoroughly for a minimum of 15 minutes with large quantities of water (preferably a safety shower). Get medical attention immediately.

EYES

Wash eyes immediately with large amounts of water (preferably eye wash fountain), lifting the upper and lower eyelids and rotating eyeball. Continue washing for a minimum of 15 minutes. Get medical attention immediately.

INGESTION

If person is conscious, give large quantities of water to dilute caustic. Do not induce vomiting. Get medical attention immediately. Do not give anything by mouth to an unconscious person.

CHRONIC TOXICITY

No known chronic effects

CARCINOGENICITY

No studies were identified relative to sodium hydroxide and carcinogenicity. Sodium hydroxide is not listed on the IARC, NTP or OSHA carcinogen lists.

REPRODUCTIVE TOXICITY

No studies were identified relative to sodium hydroxide and reproductive toxicity.

SECTION 7 PERSONAL PROTECTION AND CONTROLS

RESPIRATORY PROTECTION

Where concentrations exceed or are likely to exceed 2 mg/m^3 use a NIOSH/MSHA approved high-efficiency particulate filter with full facepiece or self-contained breathing apparatus. Follow any applicable respirator use standards and regulations.

VENTILATION

As necessary to maintain concentration in air below 2 mg/m^3 at all times.

SKIN PROTECTION

Wear neoprene, PVC, or rubber gloves; PVC rain suit; rubber boots with pant legs over boots.

EYE PROTECTION

Splashproof chemical goggles and faceshield.

HYGIENE

Avoid contact with skin and avoid breathing mist. Do not eat, drink, or smoke in work area. Wash hands prior to eating, drinking, or using restroom. Any protective clothing or shoes which become contaminated with caustic should be removed immediately and thoroughly laundered before any reuse.

OTHER CONTROL MEASURES

Safety shower and eyewash station must be located in immediate work area. To determine the exposure level(s), monitoring should be performed regularly.

NOTE: Protective equipment and clothing should be selected, used, and maintained according to applicable standards and regulations. For further information, contact the clothing or equipment manufacturer or the Vulcan Chemicals Technical Service Department.

SECTION 8 HANDLING AND STORAGE

Follow protective controls set forth in Section 7 when handling this product.

Store in closed, properly labeled tanks or containers. Do not remove or deface labels or tags.

When diluting with water, slowly add caustic solution to the water. Heat will be produced during dilution. Full protective clothing, goggles and faceshield should be worn. Do not add water to caustic because excessive heat formation will cause boiling and spattering.

Contact of caustic soda cleaning solutions with food and beverage products (in enclosed vessels or spaces) can produce lethal concentrations of carbon monoxide gas. Do not enter confined spaces such as tanks or pits without following proper entry procedures as required by 29 CFR 1910.146.

SARA Title III Hazard Categories: Immediate Health.

SECTION 9 SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Cleanup personnel must wear proper protective equipment (refer to Section VII). Completely contain spilled material with dikes, sandbags, etc., and prevent run-off into ground or surface waters or sewers. Recover as much material as possible into containers for disposal. Remaining material may be diluted with water and neutralized with dilute hydrochloric acid. Neutralization products, both liquid and solid, must be recovered for disposal. Reportable Quantity (RQ) is 1000 lbs. Notify National Response Center (800/424-8802) of uncontained releases to the environment in excess of the RQ.

WASTE DISPOSAL METHOD

Recovered solids or liquids may be sent to a licensed reclaimer or disposed of in a permitted waste management facility. Consult federal, state, or local disposal authorities for approved procedures.

SECTION 10 TRANSPORTATION INFORMATION

DOT SHIPPING DESCRIPTION (49 CFR 172.101)

Sodium Hydroxide Solution, 8, UN 1824, PG II, RQ

PLACARD REQUIRED

Corrosive, 1824, Class 8

LABEL REQUIRED

Corrosive, Class 8. Label as required by OSHA Hazard Communication Standard, and any applicable state and local regulations.

Medical Emergencies:
Call collect 24 hours a day for emergency toxicological information 415/821-3182

Other Emergency information:
Call 316/524-5751 (24 Hours)

For any other information contact:
Vulcan Chemicals
Technical and Environmental Services
P O Box 530390
Birmingham, AL 35253-0390
800/873-4898
8 AM - 5 PM, Central Time
Monday through Friday

Date of Preparation: January 15, 1996

FORM 3239-210

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Trisodium Phosphate**
- Product Use: **Anti-scalant**
- Chemical Composition: **Na_3PO_4**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Continuous low-concentration feed during operation**
- Product toxicity data: **Not Available**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300
National Response In Canada
CANUTEC: 613-996-6666
Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Sodium Phosphate, Tribasic, 12-Hydrate

1. Product Identification

Synonyms: Trisodium Phosphate, 12-Hydrate; Phosphoric Acid, Trisodium Salt, Dodecahydrate
CAS No.: 7601-54-9 (Anhydrous) 10101-89-0 (Dodecahydrate)
Molecular Weight: 380.12
Chemical Formula: Na3PO4 . 12H2O
Product Codes: 3836, 3840

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Phosphate, Tribasic	7601-54-9	98 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:
Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Behaves as a moderately strong alkali; intense exposure may result in the destruction of mucous membranes. May cause asthmatic bronchitis, chemical pneumonitis, or pulmonary edema.
Ingestion:
Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea. May cause mild burning of mouth, throat, and stomach. Its alkaline nature may injure the esophagus and digestive tract. Aqueous, highly alkaline solutions may produce caustic burns.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. Extent of damage depends on duration of contact. More serious effects may occur if the skin is moist. Aqueous, highly alkaline solutions may produce caustic burns.
Eye Contact:
Causes irritation to eyes, may be severe with possible corneal damage. Aqueous, highly alkaline solutions may produce caustic burns.
Chronic Exposure:
Repeated exposure may cause symptoms similar to those listed for acute effects. May cause permanent tissue damage to the skin and eyes.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Do NOT induce vomiting. Give large amounts of water. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust

dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Trisodium phosphate:
-AIHA Workplace Environmental Exposure Limit:
5 mg/m3 (15-minute STEL)
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with high efficiency particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type Ror P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
White crystalline solid.
Odor:
Odorless.
Solubility:
Appreciable (> 10%)
Specific Gravity:
1.62
pH:
Strongly alkaline.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
Decomposes.
Melting Point:

73.3 - 76.7C (163 - 171F)
Vapor Density (Air=1):
Not applicable.
Vapor Pressure (mm Hg):
Not applicable.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Sodium and phosphorus oxides may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Reacts violently with water and acids to liberate heat.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Trisodium Phosphate: Investigated as a mutagen. Trisodium Phosphate, Dodecahydrate: 7400 mg/kg oral rat LD50.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Sodium Phosphate, Tribasic (7601-54-9)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Sodium Phosphate, Tribasic (7601-54-9)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Sodium Phosphate, Tribasic (7601-54-9)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Sodium Phosphate, Tribasic (7601-54-9)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Sodium Phosphate, Tribasic (7601-54-9)	5000	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: 2 Flammability: 0 Reactivity: 1
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.
Label Precautions:
Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
Avoid breathing dust.
Keep container closed.
Use only with adequate ventilation.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
****

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Disodium Phosphate**
- Product Use: **Anti-scalant**
- Chemical Composition: **Na_2HPO_4**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Continuous low-concentration feed during operation**
- Product toxicity data: **Not Available**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

SAFETY DATA SHEET

1. Identification

Product identifier: SODIUM PHOSPHATE DIBASIC ANHYDROUS

Other means of identification
Synonyms: Disodium phosphate, DSP, Disodium hydrogen phosphate
Product No.: 4062, 3830, 3827, 3826, 3804, 3828, 7920, 7917, 7771, 73815

Recommended use and restriction on use
Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company Name:	Avantor Performance Materials, Inc.
Address:	3477 Corporate Parkway, Suite 200 Center Valley, PA 18034
Telephone:	Customer Service: 855-282-6867
Fax:	
Contact Person:	Environmental Health & Safety
e-mail:	info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Health hazards

Serious eye damage/eye irritation — Category 2B

Label elements

Hazard symbol: No symbol

Signal word: Warning

Hazard statement: Causes eye irritation.

Precautionary statement

Prevention: Wash hands thoroughly after handling.

Response: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Substances

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
SODIUM PHOSPHATE, DIBASIC		7558-79-4	98 - 100%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. If medical advice is needed, have product container or label at hand. Show this safety data sheet to the doctor in attendance.

Ingestion: Rinse mouth thoroughly. Call a POISON CENTER or doctor/physician if you feel unwell.

Inhalation: Move to fresh air. Get medical attention if symptoms persist.

Skin contact: Wash skin thoroughly with soap and water. Get medical attention if irritation persists after washing. Wash contaminated clothing before reuse.

Eye contact: Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. If eye irritation persists: Get medical advice/attention.

Most important symptoms/effects, acute and delayed

Symptoms: May cause irritation to skin, eyes, and respiratory tract.

Indication of immediate medical attention and special treatment needed

Treatment: Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards: The product is non-combustible.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media: None known.

Specific hazards arising from the chemical: During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters

Special fire fighting procedures: Move containers from fire area if you can do so without risk. Use water spray to keep fire-exposed containers cool. Cool containers exposed to flames with water until well after the fire is out.

Special protective equipment for fire-fighters: Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures: Keep unauthorized personnel away. Use personal protective equipment. See Section 8 of the MSDS for Personal Protective Equipment.

Methods and material for containment and cleaning up: Sweep up and place in a clearly labeled container for chemical waste. Clean surface thoroughly to remove residual contamination.

Notification Procedures: Prevent entry into waterways, sewer, basements or confined areas. Inform authorities if large amounts are involved.

Environmental precautions: Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling: Use personal protective equipment as required. Avoid contact with eyes, skin, and clothing. Avoid inhalation of dust. Wash thoroughly after handling.

Conditions for safe storage, including any incompatibilities: Keep container tightly closed. Store in cool, dry place. Store in a well-ventilated place.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None of the components have assigned exposure limits.

Appropriate engineering controls No data available.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Eye/face protection: Use tight fitting goggles if dust is generated.

Skin protection

Hand protection: Wear protective gloves.

Other: Wear suitable protective clothing.

Respiratory protection: In case of inadequate ventilation use suitable respirator.

Hygiene measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Provide eyewash station and safety shower.

9. Physical and chemical properties

Appearance

Physical state:	Solid
Form:	Granules
Color:	White
Odor:	Odorless
Odor threshold:	No data available.
pH:	9.1 (25 °C) (1% solution)
Melting point/freezing point:	No data available.
Initial boiling point and boiling range:	No data available.
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Relative density:	2.07 (20 °C)
Solubility(ies)	
Solubility in water:	Soluble
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

Other information

Molecular weight:	141.98 g/mol (H3O4P.2Na)

10. Stability and reactivity

Reactivity:	No dangerous reaction known under conditions of normal use.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur.
Conditions to avoid:	Contact with incompatible materials. The substance is hygroscopic and will absorb water by contact with the moisture in the air.
Incompatible materials:	Acids.
Hazardous decomposition products:	oxides of phosphorus Sodium oxides

11. Toxicological information

Information on likely routes of exposure

Ingestion:	May cause irritation of the gastrointestinal tract.
Inhalation:	Dust may irritate respiratory system or lungs.

Skin contact: Causes mild skin irritation.

Eye contact: Causes eye irritation.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: LD 50 (Rat): 17 g/kg

Dermal
Product: No data available.

Inhalation
Product: No data available.

Repeated dose toxicity
Product: No data available.

Skin corrosion/irritation
Product: May cause skin irritation.

Serious eye damage/eye irritation
Product: May irritate eyes.

Respiratory or skin sensitization
Product: Not a skin sensitizer.

Carcinogenicity
Product: This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro
Product: No mutagenic components identified

In vivo
Product: No mutagenic components identified

Reproductive toxicity
Product: No components toxic to reproduction

Specific target organ toxicity - single exposure
Product: None known.

Specific target organ toxicity - repeated exposure
Product: None known.

Aspiration hazard
Product: Not classified

Other effects: None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish
Product: No data available.

Aquatic invertebrates
Product: No data available.

Chronic hazards to the aquatic environment:

Fish
Product: No data available.

Aquatic invertebrates
Product: No data available.

Toxicity to Aquatic Plants
Product: No data available.

Persistence and degradability

Biodegradation
Product: There are no data on the degradability of this product.

BOD/COD ratio
Product: No data available.

Bioaccumulative potential
Bioconcentration factor (BCF)
Product: No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)
Product: No data available.

Mobility in soil: No data available.

Other adverse effects: The product components are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

13. Disposal considerations

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws.

Contaminated packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT
Not regulated.

IMDG
Not regulated.

IATA

Not regulated.

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)
None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):
SODIUM PHOSPHATE, DIBASIC — Reportable quantity: 5000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

[X] Acute (Immediate) [ ] Chronic (Delayed) [ ] Fire [ ] Reactive [ ] Pressure Generating

SARA 302 Extremely hazardous substance
None present or none present in regulated quantities.

SARA 304 Emergency release notification

Chemical identity	RQ
SODIUM PHOSPHATE, DIBASIC	5000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
SODIUM PHOSPHATE, DIBASIC	500 lbs

SARA 313 (TRI reporting)
None present or none present in regulated quantities.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)
SODIUM PHOSPHATE, DIBASIC — Reportable quantity: 5000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):
None present or none present in regulated quantities.

US state regulations

US. California Proposition 65
No ingredient regulated by CA Prop 65 present.

US. New Jersey Worker and Community Right-to-Know Act
SODIUM PHOSPHATE, DIBASIC — Listed

US. Massachusetts RTK - Substance List
SODIUM PHOSPHATE, DIBASIC — Listed

US. Pennsylvania RTK - Hazardous Substances
SODIUM PHOSPHATE, DIBASIC — Listed

US. Rhode Island RTK

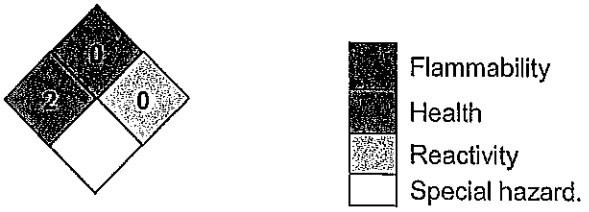
No ingredient regulated by RI Right-to-Know Law present.

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
Japan (ENCS) List:	On or in compliance with the inventory
China Inv. Existing Chemical Substances:	Not in compliance with the inventory.
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Japan ISHL Listing:	On or in compliance with the inventory
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue date:	05-27-2014
Revision date:	No data available.
Version #:	1.1
Further information:	No data available.

Disclaimer:

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Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **PermaClean PC-11**
- Product Use: **Biocide**
- Chemical Composition: **$C_2H_3Br_2N_2O$**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Continuous low-concentration feed during operation**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

NALCO

SAFETY DATA SHEET

PRODUCT

PermaClean® PC-11

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : PermaClean® PC-11

APPLICATION : BIOCIDE

COMPANY IDENTIFICATION :
Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 3 / 3* FLAMMABILITY : 1 / 1 INSTABILITY : 1 / 1 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
Dibromoacetonitrile	3252-43-5	1.0 - 5.0
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	10.0 - 30.0
Polyethylene Glycol	25322-68-3	30.0 - 60.0

3. HAZARDS IDENTIFICATION

****EMERGENCY OVERVIEW****

DANGER
CORROSIVE: Causes irreversible eye damage. May be fatal if inhaled or swallowed. Causes skin irritation. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.
Do not get in eyes, on skin or on clothing. Do not breathe dust. When loading or handling wear protective eyewear (goggles or face shield), long-sleeved shirt and long pants, socks, shoes, chemically resistant gloves and a NIOSH approved respirator. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing separated from other before reuse.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin, Inhalation

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
Corrosive. Will cause eye burns and permanent tissue damage.

SKIN CONTACT :
May cause severe irritation or tissue damage depending on the length of exposure and the type of first aid administered. May cause sensitization by skin contact.

INGESTION :
Not a likely route of exposure. Corrosive; causes chemical burns to the mouth, throat and stomach. May be fatal if swallowed.

INHALATION :
Irritating, in high concentrations, to the eyes, nose, throat and lungs. Harmful if inhaled. Trace levels of cyanogen bromide and dibromoacetonitrile vapors may be present in unvented containers and may be irritating. Vapours and/or aerosols which may be formed at elevated temperatures or during agitation may cause systemic effects.

AGGRAVATION OF EXISTING CONDITIONS :
A review of available data does not identify any worsening of existing conditions.

4. FIRST AID MEASURES

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

IF SWALLOWED: Call poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. Call a poison control center or doctor for treatment advice.

NOTE TO PHYSICIAN :
Aspiration may cause lung damage. Probable mucosal damage may contraindicate the use of gastric lavage. Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT : > 360 °F / > 182 °C (COC)

EXTINGUISHING MEDIA :
This product would not be expected to burn unless all the water is boiled away. The remaining organics may be ignitable. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD :

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Keep people away from and upwind of spill/leak. Ventilate spill area if possible. Ensure clean-up is conducted by trained personnel only. Do not touch spilled material. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Wash site of spillage thoroughly with water. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
This product is toxic to fish. Apply this product only as specified on this label. Do not contaminate water by cleaning of equipment, or disposal of wastes. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

7. HANDLING AND STORAGE

HANDLING :
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled.

STORAGE CONDITIONS :
Store the containers tightly closed. Store separately from oxidizers. Store in suitable labeled containers. Containers require venting bungs to avoid over pressure. Storage temperature <35°C. 6 month shelf life under given storage conditions

SUITABLE CONSTRUCTION MATERIAL :
PVC, Polypropylene, Polyethylene, Hastelloy C-276, HDPE (high density polyethylene), PTFE, Fluoroelastomer

UNSUITABLE CONSTRUCTION MATERIAL :
Copper, Brass, Aluminum, Mild steel, Buna-N, Ethylene propylene, Neoprene, Polyurethane, Stainless Steel 304, Stainless Steel 316L, Carbon steel, Chlorosulfonated polyethylene rubber

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

Substance(s)	Basis	ppm	mg/m3	Non-Standard Unit
Dibromoacetonitrile	Manufacturer's Recommendation/ TWA (Skin)			
	Manufacturer's Recommendation/ CEILING (Skin)	0.1		
2,2-Dibromo-3-nitrilopropionamide	Manufacturer's Recommendation/ TWA			
	Manufacturer's Recommendation/ CEILING		2	
Polyethylene Glycol	AIHA/WEEL/TWA		10	

* A skin notation refers to the potential significant contribution to overall exposure by the cutaneous route, including mucous membranes and the eyes.

ENGINEERING MEASURES :
General ventilation is recommended. Use local exhaust ventilation if necessary to control airborne mist and vapor.

RESPIRATORY PROTECTION :
Where concentrations in air may exceed the limits given in this section, the use of a half face filter mask or air supplied breathing apparatus is recommended. A suitable filter material depends on the amount and type of chemicals being handled. Consider the use of filter type: Organic vapor cartridge, with a Particulate pre-filter. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
When handling this product, the use of chemical gauntlets is recommended. The choice of work glove depends on work conditions and what chemicals are handled. Please contact the PPE manufacturer for advice on what type of glove material may be suitable. Gloves should be replaced immediately if signs of degradation are observed.

SKIN PROTECTION :
Wear chemical resistant apron, chemical splash goggles, impervious gloves and boots. A full slicker suit is recommended if gross exposure is possible.

EYE PROTECTION :
Wear a face shield with chemical splash goggles, unless wearing a full-face respirator.

HYGIENE RECOMMENDATIONS :
Use good work and personal hygiene practices to avoid exposure. Eye wash station and safety shower are necessary. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Clear Colorless Amber
ODOR	Mild, Disinfectant
SPECIFIC GRAVITY	1.20 - 1.30 @ 73 °F / 23 °C
DENSITY	10.0 - 10.8 lb/gal
SOLUBILITY IN WATER	Complete
pH (100 %)	1.5 - 5.0
VISCOSITY	138 cps @ 68 °F / 20 °C
POUR POINT	-49 °F / -45 °C
FREEZING POINT	-58 °F / -50 °C
BOILING POINT	> 158 °F / > 70 °C Decomposes
VAPOR PRESSURE	< 0.1 mm Hg @ 70 °F / 21 °C
VOC CONTENT	9.85 % EPA Method 24

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Heat
Keep at temperature not exceeding 95 °F

MATERIALS TO AVOID :
Contact with strong alkalies (e.g. ammonia and its solutions, carbonates, sodium hydroxide (caustic), potassium hydroxide, calcium hydroxide (lime), cyanide, sulfide, hypochlorites, chlorites) may generate heat, splattering or boiling and toxic vapors. Oxidizing agents Aluminum

HAZARDOUS DECOMPOSITION PRODUCTS :
Decomposes cyanogenbromide and dibromoacetonitrile, Bromine, Oxides of carbon

11. TOXICOLOGICAL INFORMATION

The following results are for the product along with results on the active substances.

ACUTE ORAL TOXICITY :

Species:	Rat
LD50:	178 - 235 mg/kg
Test Descriptor:	Active Substance

Species:	Guinea pig
LD50:	118 mg/kg
Test Descriptor:	Active Substance

Species:	Rabbit
LD50:	118 mg/kg
Test Descriptor:	Active Substance

Species:	Rat
LD50:	510 mg/kg
Test Descriptor:	Product

ACUTE DERMAL TOXICITY :

Species:	Rabbit
LD50:	> 2,000 mg/kg
Test Descriptor:	Product

ACUTE INHALATION TOXICITY :

Species:	Rat
LC50:	1.4 mg/l (4 hrs)
Test Descriptor:	Product
Species:	Rat
LC50:	1.25 mg/l (4 hrs)
Test Descriptor:	Product

SENSITIZATION :
Repeated or prolonged contact may cause skin sensitization.

CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: High

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the product along with results on the hazardous components. The following results are for the active components.

Acute Fish Results :

Species	Exposure	Test Type	Value	Test Descriptor
Bluegill Sunfish	96 hrs	LC50	8.9 mg/l	Product
Rainbow Trout	96 hrs	LC50	3.6 mg/l	Product
Sheepshead Minnow	96 hrs	LC50	7.5 mg/l	Product
Fathead Minnow	96 hrs	LC50	1.36 mg/l	Active Substance
Rainbow Trout	96 hrs	LC50	1 mg/l	Active Substance
Sheepshead Minnow	96 hrs	LC50	1.4 mg/l	Active Substance
Bluegill Sunfish	96 hrs	LC50	1.3 mg/l	Active Substance
Gold Orfe	96 hrs	LC50	4.7 mg/l	Product

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Mysid Shrimp (Mysidopsis bahia)	96 hrs	LC50	4.2 mg/l	Product
Daphnia magna	48 hrs	LC50	4.3 mg/l	Product
Daphnia magna	48 hrs	LC50	1.24 mg/l	Active Substance
Grass Shrimp	96 hrs	LC50	11.5 mg/l	Active Substance
Acartia tonsa	48 hrs	LC50	1.78 mg/l	Product
Ceriodaphnia dubia	48 hrs	LC50	6.67 mg/l	Product
Mysid Shrimp (Mysidopsis bahia)	96 hrs	EC50	3.2 mg/l	Product
Daphnia magna	48 hrs	EC50	2.5 mg/l	Product

AQUATIC PLANT RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Marine Algae (Skeletonema costatum)	72 hrs	LC50	1.5 mg/l	Product

AQUATIC MICROORGANISM RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Pseudomonas putida		LC50	> 2.0 mg/l	Product

ADDITIONAL ECOLOGICAL DATA
Product contains organic halogens, may contribute to AOX.
PERSISTENCY AND DEGRADATION :

Total Organic Carbon (TOC) : 280,000 mg/l

Chemical Oxygen Demand (COD) : 1,110,000 mg/l

Biological Oxygen Demand (BOD) :

Incubation Period	Value	Test Descriptor
5 d	1,100 mg/l	Product

The organic portion of this preparation is expected to be readily biodegradable.

MOBILITY :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	10 - 30%	70 - 90%

The portion in water is expected to be soluble or dispersible.

BIOACCUMULATION POTENTIAL
This substance has a low potential to bioconcentrate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Moderate

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it could meet the criteria of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Before disposal, it should be determined if the waste meets the criteria of a hazardous waste.

Hazardous Waste: D002

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical Name(s) :	2,2-DIBROMO-3-NITRILOPROPIONAMIDE
UN/ID No :	UN 3265
Hazard Class - Primary :	8
Packing Group :	III
Flash Point :	> 182 °C / > 360 °F

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical Name(s) :	2,2-DIBROMO-3-NITRILOPROPIONAMIDE
UN/ID No :	UN 3265
Hazard Class - Primary :	8
Packing Group :	III

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical Name(s) :	2,2-DIBROMO-3-NITRILOPROPIONAMIDE
UN/ID No :	UN 3265
Hazard Class - Primary :	8
Packing Group :	III
*Marine Pollutant :	2,2-Dibromo-3-nitrilopropionamide

*Note: This product is regulated as a Marine Pollutant when shipped by Rail, Highway (in bulk quantities), or Air (if no other hazard class applies), and when shipped by water in all quantities.

15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

Dibromoacetonitrile : Eye Irritant, Respiratory Irritant
2,2-Dibromo-3-nitrilopropionamide : Corrosive, Sensitizer
Polyethylene Glycol : Exposure Limit

CERCLA/SUPERFUND, 40 CFR 302 :
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
X	Delayed (Chronic) Health Hazard
-	Fire Hazard
-	Sudden Release of Pressure Hazard
-	Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product contains the following substance(s), (with CAS # and % range) which appear(s) on the List of Toxic Chemicals

Hazardous Substance(s)	CAS NO	% (w/w)
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	10.0 - 30.0

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
This product is exempted under TSCA and regulated under FIFRA. The inerts are on the Inventory List.

FEDERAL INSECTICIDE, FUNGICIDE AND RODENTICIDE ACT (FIFRA) :
EPA Reg. No. 1706-138

In all cases follow instructions on the product label.

This product has been certified as KOSHER/PAREVE for year-round use INCLUDING THE PASSOVER SEASON by the CHICAGO RABBINICAL COUNCIL.

NSF INTERNATIONAL :
This product has received NSF/International certification under NSF/ANSI Standard 60 as a Reverse Osmosis Membrane Biocide. The official name is "Miscellaneous Water Supply Products." Membrane cleaner. This product is designed to be used off-line and flushed out prior to using the system for drinking water.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CLEAN AIR ACT, Sec. 112 (Hazardous Air Pollutants, as amended by 40 CFR 63), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CALIFORNIA PROPOSITION 65 :
This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels, which would require a warning under the statute.

MICHIGAN CRITICAL MATERIALS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

STATE RIGHT TO KNOW LAWS :
This product is a registered biocide and is exempt from State Right to Know Labelling Laws.

INTERNATIONAL CHEMICAL CONTROL LAWS :

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
Substances regulated under the Pest Control Products Act are exempt from CEPA New Substance Notification requirements.

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS Inventories.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

NEW ZEALAND
All substances in this product comply with the Hazardous Substances and New Organisms (HSNO) Act 1996,and are listed on or are exempt from the New Zealand Inventory of Chemicals.

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),
Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date Issued : 02/19/2013
Version Number : 3.3

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Anodamine HPFG+**
- Product Use: **Anti-scalant and corrosion inhibitor**
- Chemical Composition: **Proprietary**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Continuous low-concentration feed during operation**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

MATERIAL SAFETY DATA SHEET

Manufactured exclusively in the USA using locally manufactured and supplied raw materials

Date Issued: 5/24/2013
Revised: 24 May 2013
MSDS Ref. No: MSDS-USA-05-24-HPFG+
Revision No: 20 New MSDS original.

1. PRODUCT AND COMPANY IDENTIFICATION

GENERAL USE: High Pressure Boiler Metal Passivation Scale and Corrosion Inhibition.
PRODUCT DESCRIPTION: Proprietary non-toxic mixture of surface-active polyamines.
PRODUCT CODE: anodamine™ HPFG+ proprietary blend.
PRODUCT FORMULATION NAME: anodamine™ HPFG+
CHEMICAL FAMILY: Surface active amines.
MOLECULAR FORMULA: Proprietary

2. COMPOSITION / INFORMATION OF INGREDIENTS

Chemical Name	Wt. %	CAS #	EINECS #
Typical CAS components (unknown)	Proprietary Non Toxic Components		

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
PHYSICAL APPEARANCE: Clear to colorless organic liquid with limited odor.
IMMEDIATE CONCERNS: None.

POTENTIAL HEALTH EFFECTS
EYES: Expected to cause mild irritation to the eyes with exposed contact.
SKIN: May cause mild irritation to the skin of some.
SKIN ABSORPTION: None expected.
INGESTION: May cause mild irritation to the digestive tract if ingested in small quantities.
INHALATION: No irritation to the lungs, upper respiratory tract and nose with extended exposure.
ACUTE TOXICITY: No test data is available for acute dermal toxicity.
No test data is available for acute ingestion toxicity.

4. FIRST AID MEASURES

EYES: Immediately flush eyes with plenty of water for two to three minutes. Remove any contact lenses and continue flushing for 15 minutes. Get medical attention.

SKIN: Remove contaminated clothing including shoes and immediately wash affected area with plenty of soap and water. Wash contaminated clothing and shoes before reuse.

INGESTION: Wash out mouth with water. Seek medical attention.

INHALATION: No affects or symptoms are expected when handling the product. No respiratory PPE is required.

ADDITIONAL INFORMATION: None.

COMMENTS: None.

5. **FIRE FIGHTING MEASURES**

FLASHPOINT AND METHOD: None Expected.

FLAMMABLE LIMITS: None flammable.

AUTOIGNITION TEMPERATURE: None

6. **ACCIDENTAL RELEASE MEASURES**

SMALL SPILL: The HPFG has an LD50 of 89,500 mg/kg, accordingly small leaks of less than 100 lt can be diluted with water and washed with no known risk to the waterways or alternatively, spilt material can be absorbed on to absorbent materials and discarded without regulations at appropriate waste disposal facilities according to current applicable local laws and regulations.

LARGE SPILL: Good practice would dictate that large spills should be absorbed on to absorbent materials and discarded without regulations at appropriate waste disposal facilities according to current applicable local laws and regulations.

ENVIRONMENTAL PRECAUTIONS

WATER SPILL:
This material will not cause adverse environmental impact if it reaches waterways. The material is considered as NON-HAZARDOUS to the aquatic environment.

LAND SPILL: None

AIR SPILL: None known.

GENERAL PROCEDURES: Absorb material, shovel up and dispose of at an appropriate waste disposal facility according to current applicable laws and regulations, and product characteristics at time of disposal.

RELEASE NOTES:
This material will not cause adverse environmental impact if it reaches waterways. The material is considered as NON-HAZARDOUS to the aquatic environment.
In case of accident or road spill notify: CHEMTREC in USA at 800-424-9300 CANUTEC in Canada at 613-996-6666 CHEMTREC, other countries, at (International code) +1 703 527 3887
SPECIAL PROTECTIVE EQUIPMENT: CHEMTREC in USA at 800-424-9300 CANUTEC in Canada at 613-996-6666 CHEMTREC, other countries, at (International code) +1 703 527 3887
COMMENTS: See Section 13 for disposal information and Section 15 for regulatory requirements. Large and small spills may have a broad definition depending on the user's handling system. Therefore technically qualified personnel must define the spill category at the point of release.

7. HANDLING AND STORAGE

GENERAL PROCEDURES: Store the product out of direct sun and ideally under roof. Storage of the product at temperatures > 33 °F (freeze protection) or < 180 °F typically ensure a useable shelf life of 3 – 5 years. Even after freezing, thawing allows re-use of the product without limitations.

HANDLING: Use appropriate personal protective equipment as specified in Section 8. Handle and use in a manner consistent with good industrial/manufacturing techniques and responsible chemical handling practices.

STORAGE: Store in unopened containers under cool and dry conditions.

STORAGE TEMPERATURE: Ambient conditions. Avoid extended exposure to direct sun with open containers. There is no known product degradation during exposure to these storage conditions.

LOADING TEMPERATURE: NA = Not Applicable

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE GUIDELINES:

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200)

Toxicological results for bioassays on corrosion inhibitor amodamine HPFG.

Investigative Species	*Observations*
	LC50
Daphnia Pulex 48 hour	**89,531.36 ppm** 95 % Lower Confidence Limit: 86,079.85 ppm 95 % Upper Confidence Limit: 93,121.27 ppm
Pimephales Promelas 96 hour	**49,210.46 ppm** 95 % Lower Confidence Limit: 55,755.86 ppm 95 % Upper Confidence Limit: 43,433.46 ppm

Environmental Protection Agency's Trimmed Spearman-Karber statistical program was used to analyze all data.
The 48-Hour LC-50 (concentration at which 50% mortality is expected to occur) for amodamine™ HPFG, Daphnia pulex survival data, was calculated by the Spearman- Karber program, as 89,531.36 ppm.
The 96-Hour LC-50 (concentration at which 50% mortality is expected to occur) for amodamine™ HPFG, Pimephales promelas survival data, was calculated by the Spearman-Karber program, as 49,210.46 ppm.
Both the lethal and sub-lethal endpoints were statistically calculated according to their respective EPA guidelines. The Chronic Freshwater organisms were calculated according to EPA-821-R-02-013, October 2002 Fourth Edition. The Chronic Marine and Estuarine organisms were calculated according to EPA-821-R-02-014, October 2002 Third Edition. The Acute Freshwater and Marine organisms were calculated according to EPA-821-R-02-012, October 2002 Fifth Edition.

ENGINEERING CONTROLS: Normal ventilation is required when handling or using this material.

PERSONAL PROTECTIVE EQUIPMENT

EYES AND FACE: Wear safety glasses with side shields or goggles when handling this material.

SKIN: Wear basic nitrile or latex disposable protective gloves.

RESPITORY: No special precautions are necessary under normal operating conditions and with adequate ventilation.

PROTECTIVE CLOTHING: None

WORK HYGIENIC PRACTICES: Good Personal hygiene practices should always be followed.

OTHER USE PRECAUTIONS: None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE:	Liquid
ODOR:	Trace smell of amine
APPEARANCE:	Clear liquid, depending on age/concentration slight straw color.
COLOR:	Colorless
pH:	~ 6.0
PERCENT VOLATILE:	~ 1 % of non hazardous active in water steam phase at > 250°C
BOILING POINT:	similar to water
SPECIFIC GRAVITY:	0.98

10. STABILITY AND REACTIVITY

STABLE: YES
HAZARDOUS POLYMERIZATION: NO
CONDITIONS TO AVOID: None
STABILITY: The product is stable under normal ambient conditions of temperature and pressure.
POLYMERIZATION: None
HAZARDOUS DECOMPOSITION PORDUCTS: At temperatures above 600°C decomposition products in the presence of oxygen may include trace quantities of carbon dioxide.

INCOMPATIBLE MATERIALS: Strong Acids.

COMMENTS: None Expected

11. TOXICOLOGICAL INFORMATION

ACUTE

DERMAL LD_{50}: ~ 90,000 Dermal LD50 (rabbit) = 90,000 mg/kg

EYE EFFECTS: This material is not expected to cause significant irritation to the eyes.

SKIN EFFECTS: This material is not expected to cause significant irritation to the skin.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL DATA: This material will not cause adverse environmental impact if it reaches waterways. The material is considered as NON-HAZARDOUS to the aquatic environment.

ECOTOXICOLOGICAL INFORMATION:

Acute toxicity test in *Daphnia sp.* (OECD 202, 2004)
It was established, Environmental Protection Agency's Trimmed Spearman-Karber statistical program was used to analyze all data. The 48-Hour LC-50 (concentration at which 50% mortality is expected to occur) for amodamine™ HPFG, Daphnia pulex survival data, was calculated by the Spearman- Karber program, as 89,531.36 ppm. The 96-Hour LC-50 (concentration at which 50% mortality is expected to occur) for amodamine™ HPFG, Pimephales promelas survival data, was calculated by the Spearman-Karber program,

as 49,210.46 ppm, for the corrosion inhibitor sample [redacted] HPFG food grade was well above **100 mg/L, therefore the sample is classified as NON-HAZARDOUS to the aquatic environment.**
Other information:
Biological Degradability: >554% (BSB_{12}/CSB*100), product may be slightly retained by silicate containing soil.
Class of Water Endangerment: 1 (self classification): slight danger to water

DISTRIBUTION: The material is readily biodegradable based on a 28-day study with oxygen depletion of at least 90% of the theoretical maxima.

CHEMICAL FATE INFORMATION: Class of Water Endangerment: 1 (self classification): slight danger to water.

COMMENTS: Information based upon data for an equivalent product and analog.

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: Dispose of waste at an appropriate waste disposal facility according to current applicable laws and regulations.

FOR LARGE SPILLS: This material will not cause adverse environmental impact if it reaches waterways.

PRODUCT DISPOSAL: Collect in appropriate containers. Dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulation, and product characteristics at time of disposal.

EMPTY CONTAINER: Triple rinse (or equivalent) all containers and offer for recycling or reconditioning, or punctures and disposes of in a sanitary landfill or other procedures approved by state and local authorities.

RCRA/EPA WASTE INFORMATION: NA

RCRA HAZARD CLASS: None Expected

14. TRANSPORTATION INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION)

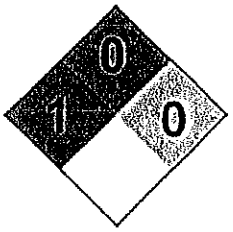
TECHNICAL NAME:	Proprietary Formulation.
PRIMARY HAZARD CLASS/DIVISION:	Non-Hazardous Material.
LABEL:	N/A
MARINE POLLUTANT #1:	None Expected
MARINE POLLUTANT #2:	No Data Available Contact Env. Dept.
OTHER SHIPPING INFORMATION:	Not a regulated material.
Road Transport ADR/RID and GGVS/GGVE:	Non-dangerous goods
Sea Transport IMDG/GGVSee:	Non-dangerous goods
Air Transport ICAO-TI and IATA-DGR:	Non-dangerous goods

15. REGULATORY INFORMATION

UNITED STATES SARA TITLE III
(SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT)
311/312 HAZARD CATEGORIES: NA
FIRE: NO **PRESSURE GENERATING:** NO **REACTIVITY:** NO
ACUTE: NO **CHRONIC:** NO

313 REPORTABLE INGREDIENTS:	NA
TITLE III NOTES:	NOT YET DETERMINED
CERCLA (COMPREHENSIVE RESPONSE, COMPENSATION, AND LIABILITY ACT)	
CERCLA REGULATORY:	NOT YET DETERMINED
EPA	
EPA RQ INGREDIENT:	NONE EXPECTED
EPA RQ PRODUCT:	NONE KNOWN
TSCA (TOXIC SUBSTANCE CONTROL ACT)	
TSCA REGULATORY:	NA
TSCA STATUS:	NA

16. OTHER INFORMATION:



PREPARED BY: Paul R. Hattingh
INFORMATION CONTACT: Product Stewardship Analyst.
MANUFACTURER DISCLAIMER: Information given herein is offered in good faith as accurate, but without guarantee. Conditions of use and suitability of the product for particular uses are beyond our control; all risks of use of the product are therefore assumed by the user. Nothing is intended as a recommendation for uses which infringe valid patents or as extending license under valid patents. Appropriate warnings and safe handling procedures should be provided to handlers and users.

ADDITIONAL MSDS INFORMATION: The information given is based on the present state of knowledge and experience according to the law on declaration and preparation of dangerous chemicals as well as on toxicological investigations for self-classification in the class of water endangerment according the concept of self-classification of preparations.

GENERAL STATEMENTS: This product and its handling should attract sensible and good housekeeping practice, the use of PPE typical for handling of any chemicals.

Made in America

All anodamine™ proprietary metal surface-active protection products are exclusively manufactured in the USA using locally sourced raw materials.

Sole manufacture and distribution by anodamine™ Inc
2590 Oakmont Drive
Building 300
Round Rock Texas, 78665
Tel: + 1 (512) 244 2318
www.anodamine.com

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Sulfuric Acid**
- Product Use: **Raw water treatment**
- Chemical Composition: **H_2SO_4**
- Classification (non-persistent, persistent or bioaccumulative): **Non-persistant**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Intermittent use as needed.**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

SAFETY DATA SHEET

1. Identification

Product identifier: Sulfuric Acid

Other means of identification
Product No.: 9661, 3780, 9704, 9682, V648, V225, V186, V008, 6902, 2900, 2879, 2878, 2877, 2874, 6163, H996, H976, 5859, 2876, 5815, 5802, 9691, 9690, 9684, 9681, 9675, 9674, 9673, 9671, 5557, 5374, 21208, 21201

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company Name:	Avantor Performance Materials, Inc.
Address:	3477 Corporate Parkway, Suite 200 Center Valley, PA 18034
Telephone:	Customer Service: 855-282-6867
Fax:	
Contact Person:	Environmental Health & Safety
e-mail:	info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Physical hazards

Corrosive to metals	Category 1

Health hazards

Skin corrosion/irritation	Category 1
Serious eye damage/eye irritation	Category 1
Carcinogenicity	Category 1A
Specific target organ toxicity - single exposure	Category 3

Environmental hazards

Acute hazards to the aquatic environment	Category 3

Label elements

Hazard symbol:

Signal word: Danger

Hazard statement: May be corrosive to metals.
Causes severe skin burns and eye damage.
May cause respiratory irritation.
May cause cancer if inhaled.
Harmful to aquatic life.

Precautionary statement

Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep only in original container. Wash thoroughly after handling. Do not breathe dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection.

Response: IF exposed or concerned: Get medical advice/attention. Absorb spillage to prevent material damage. Immediately call a POISON CENTER or doctor/physician. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

Storage: Store locked up. Store in corrosive resistant container with a resistant inner liner. Store in a well-ventilated place. Keep container tightly closed.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Substances

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
SULFURIC ACID		7664-93-9	90 - 100%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Call a physician or poison control center immediately. Do NOT induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Inhalation: Move to fresh air. Call a physician or poison control center immediately. Apply artificial respiration if victim is not breathing If breathing is difficult, give oxygen.

Skin contact:	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician or poison control center immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.
Eye contact:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a physician or poison control center immediately. In case of irritation from airborne exposure, move to fresh air. Get medical attention immediately.

Most important symptoms/effects, acute and delayed

Symptoms:	Corrosive to skin and eyes.

Indication of immediate medical attention and special treatment needed

Treatment:	Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards:	In case of fire and/or explosion do not breathe fumes.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:	Foam, carbon dioxide or dry powder.
Unsuitable extinguishing media:	Do not use water as an extinguisher.
Specific hazards arising from the chemical:	Fire may produce irritating, corrosive and/or toxic gases.

Special protective equipment and precautions for firefighters

Special fire fighting procedures:	Move containers from fire area if you can do so without risk. Fight fire from a protected location. Use water SPRAY only to cool containers! Do not put water on leaked material. Cool containers exposed to flames with water until well after the fire is out.
Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	Keep unauthorized personnel away. Keep upwind. Use personal protective equipment. See Section 8 of the MSDS for Personal Protective Equipment. Ventilate closed spaces before entering them. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
Methods and material for containment and cleaning up:	Neutralize spill area and washings with soda ash or lime. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal.
Notification Procedures:	Dike for later disposal. Prevent entry into waterways, sewer, basements or confined areas. Stop the flow of material, if this is without risk. Inform authorities if large amounts are involved.

Environmental precautions: Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling: Do not get in eyes, on skin, on clothing. Do not taste or swallow. Wash hands thoroughly after handling. Do not eat, drink or smoke when using the product. Use caution when adding this material to water. Add material slowly when mixing with water. Do not add water to the material; instead, add the material to the water. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Use personal protective equipment as required.

Conditions for safe storage, including any incompatibilities: Do not store in metal containers. Keep in a cool, well-ventilated place. Keep container tightly closed. Store in a dry place.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values	Source
SULFURIC ACID - Thoracic fraction.	TWA	0.2 mg/m3	US. ACGIH Threshold Limit Values (2011)
SULFURIC ACID	REL	1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	TWA	1 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)

Appropriate engineering controls No data available.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area.

Eye/face protection: Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection: Chemical resistant gloves

Other: Wear suitable protective clothing.

Respiratory protection: In case of inadequate ventilation use suitable respirator. Chemical respirator with acid gas cartridge.

Hygiene measures: Provide eyewash station and safety shower. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned.

9. Physical and chemical properties

Appearance

Physical state:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Odorless
Odor threshold:	No data available.
pH:	0.3 (1 N aqueous solution)
Melting point/freezing point:	3 °C
Initial boiling point and boiling range:	337 °C
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Relative density:	1.84 (20 °C)
Solubility(ies)	
Solubility in water:	Miscible with water.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	Reacts violently with strong alkaline substances.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur. Material reacts with water.
Conditions to avoid:	Moisture. Heat. Contact with incompatible materials.
Incompatible materials:	Water. Cyanides. Strong oxidizing agents. Strong reducing agents. Metals. Halogens. Organic compounds. Potassium.
Hazardous decomposition products:	Oxides of sulfur.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	May cause burns of the gastrointestinal tract if swallowed.
Inhalation:	May cause damage to mucous membranes in nose, throat, lungs and bronchial system.
Skin contact:	Causes severe skin burns.
Eye contact:	Causes serious eye damage.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: No data available.

Dermal
Product:
No data available.

Inhalation
Product: No data available.

Specified substance(s):
SULFURIC ACID — LC 50 (Guinea pig, 8 h): 0.03 mg/l
LC 50 (Rat, 1 h): 347 mg/l

Repeated dose toxicity
Product: No data available.

Skin corrosion/irritation
Product: Causes severe skin burns.

Serious eye damage/eye irritation
Product: Causes serious eye damage.

Respiratory or skin sensitization
Product: Not a skin sensitizer.

Carcinogenicity
Product: May cause cancer.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

SULFURIC ACID — Overall evaluation: 1. Carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens:
SULFURIC ACID — Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro
Product: No mutagenic components identified

In vivo
Product: No mutagenic components identified

Reproductive toxicity
Product: No components toxic to reproduction

Specific target organ toxicity - single exposure
Product: Respiratory tract irritation.

Specific target organ toxicity - repeated exposure
Product: None known.

Aspiration hazard
Product: Not classified

Other effects: No data available.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product: No data available.

Specified substance(s):

SULFURIC ACID — LC 50 (Starry, european flounder (Platichthys flesus), 48 h): 100 - 330 mg/l Mortality
LC 50 (Western mosquitofish (Gambusia affinis), 96 h): 42 mg/l Mortality

Aquatic invertebrates

Product: No data available.

Specified substance(s):

SULFURIC ACID — LC 50 (Common shrimp, sand shrimp (Crangon crangon), 48 h): 70 - 80 mg/l Mortality
LC 50 (Aesop shrimp (Pandalus montagui), 48 h): 42.5 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish

Product: No data available.

Aquatic invertebrates

Product: No data available.

Toxicity to Aquatic Plants

Product: No data available.

Persistence and degradability

Biodegradation

Product: There are no data on the degradability of this product.

BOD/COD ratio

Product: No data available.

Bioaccumulative potential

Bioconcentration factor (BCF)

Product: No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)

Product: No data available.

Mobility in soil: The product is water soluble and may spread in water systems.

Other adverse effects: The product contains a substance which is harmful to aquatic organisms. The product may affect the acidity (pH-factor) in water with risk of harmful effects to aquatic organisms.

13. Disposal considerations

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws.

Contaminated packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 1830
UN proper shipping name:	Sulfuric acid
Transport hazard class(es)	
Class(es):	8
Label(s):	8
Packing group:	II
Marine Pollutant:	No

IMDG

UN number:	UN 1830
UN proper shipping name:	SULPHURIC ACID (with more than 51% acid)
Transport hazard class(es)	
Class(es):	8
Label(s):	8
EmS No.:	F-A, S-B
Packing group:	II
Marine Pollutant:	No

IATA

UN number:	UN 1830
Proper Shipping Name:	Sulphuric acid
Transport hazard class(es):	
Class(es):	8
Label(s):	8
Marine Pollutant:	No
Packing group:	II

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

SULFURIC ACID Reportable quantity: 1000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

[X] Acute (Immediate) [X] Chronic (Delayed) [ ] Fire [ ] Reactive [ ] Pressure Generating

SARA 302 Extremely hazardous substance

Chemical identity	RQ	Threshold Planning Quantity
SULFURIC ACID	1000 lbs.	1000 lbs.

SARA 304 Emergency release notification

Chemical identity	RQ
SULFURIC ACID	1000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
SULFURIC ACID	500lbs

SARA 313 (TRI reporting)

Chemical identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
SULFURIC ACID	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)
SULFURIC ACID Reportable quantity: 1000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):
SULFURIC ACID Threshold quantity: 10000 lbs

US state regulations

US. California Proposition 65
SULFURIC ACID Carcinogenic.

US. New Jersey Worker and Community Right-to-Know Act
SULFURIC ACID Listed

US. Massachusetts RTK - Substance List
SULFURIC ACID Listed

US. Pennsylvania RTK - Hazardous Substances
SULFURIC ACID Listed

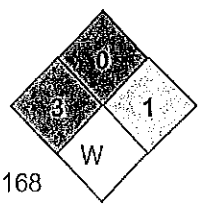
US. Rhode Island RTK
SULFURIC ACID Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EU EINECS List:	On or in compliance with the inventory
EU ELINCS List:	Not in compliance with the inventory.
Japan (ENCS) List:	On or in compliance with the inventory
EU No Longer Polymers List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Switzerland Consolidated Inventory:	Not in compliance with the inventory.
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Flammability
Health


Reactivity
Special hazard.

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe
W: Water-reactive

Issue date:	06-11-2014
Revision date:	No data available.
Version #:	1.1
Further information:	No data available.
Disclaimer:	THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED "AS IS," AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION<(>,<)> WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Ferralyte 8130**
- Product Use: **Coagulant for raw water treatment**
- Chemical Composition: **$Fe_2(SO_4)_3$**
- Classification (non-persistent, persistent or bioaccumulative): **Believed Non-persistent**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Intermittent use as needed**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

NALCO

SAFETY DATA SHEET

PRODUCT

FERRALYTE® 8130

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : **FERRALYTE® 8130**

APPLICATION : COAGULANT

COMPANY IDENTIFICATION : Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 2 / 2 FLAMMABILITY : 0 / 0 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
Ferric Sulfate	10028-22-5	30.0 - 60.0

3. HAZARDS IDENTIFICATION

****EMERGENCY OVERVIEW****

WARNING
Irritating to eyes and skin. Harmful if swallowed.
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water.
Wear suitable protective clothing.
Not flammable or combustible. Contact with reactive metals (e.g. aluminum) may result in the generation of flammable hydrogen gas. May evolve oxides of nitrogen (NOx) and sulfur (SOx) under fire conditions. May evolve oxides of carbon (COx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
Irritating, and may injure eye tissue if not removed promptly.

SKIN CONTACT :
Can cause moderate irritation.

INGESTION :
Not a likely route of exposure. Harmful if swallowed. There may be irritation to the gastro-intestinal tract.

INHALATION :
Not a likely route of exposure. Elevated temperatures or mechanical action may form vapors, mists or fumes which may be irritating to the eyes, nose, throat and lungs.

SYMPTOMS OF EXPOSURE :
Acute :
A review of available data does not identify any symptoms from exposure not previously mentioned.
Chronic :
A review of available data does not identify any symptoms from exposure not previously mentioned.

HUMAN HEALTH HAZARDS - CHRONIC :
No adverse effects expected other than those mentioned above.

4. FIRST AID MEASURES

EYE CONTACT :
Immediately flush eye with water for at least 15 minutes while holding eyelids open. If symptoms develop, seek medical advice.

SKIN CONTACT :
Flush affected area with water. If symptoms develop, seek medical advice.

INGESTION :
Get medical attention. Do not induce vomiting without medical advice. If conscious, washout mouth and give water to drink.

INHALATION :
Remove to fresh air, treat symptomatically. If symptoms develop, seek medical advice.

NOTE TO PHYSICIAN :
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT : > 200 F/ > 93.3 °C

EXTINGUISHING MEDIA :
Not expected to burn. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD :
Not flammable or combustible. Contact with reactive metals (e.g. aluminum) may result in the generation of flammable hydrogen gas. May evolve oxides of nitrogen (NOx) and sulfur (SOx) under fire conditions. May evolve oxides of carbon (COx) under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Ventilate spill area if possible. Ensure clean-up is conducted by trained personnel only. Do not touch spilled material. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
This product may pose a risk to the aquatic ecosystem if released., Prevent material from entering sewers or waterways.

7. HANDLING AND STORAGE

HANDLING :
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Do not breathe vapors/gases/dust. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled.

STORAGE CONDITIONS :
Store in suitable labeled containers. Store the containers tightly closed. Store separately from bases.

SUITABLE CONSTRUCTION MATERIAL :
Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use.

UNSUITABLE CONSTRUCTION MATERIAL :
Aluminum

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

Substance(s)	Category:	ppm	mg/m3	Non-Standard Unit

ENGINEERING MEASURES :
The use of local exhaust ventilation is recommended to control emissions near the source. Laboratory samples should be handled in a fumehood. Provide mechanical ventilation of confined spaces.

RESPIRATORY PROTECTION :
Where concentrations in air may exceed the limits given in this section, the use of a half face filter mask or air supplied breathing apparatus is recommended. A suitable filter material depends on the amount and type of chemicals being handled. Consider the use of filter type: Multi-contaminant cartridge. with a Particulate pre-filter. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
When handling this product, the use of chemical gauntlets is recommended. The choice of work glove depends on work conditions and what chemicals are handled, but we have positive experience under light handling conditions using gloves made from PVC Gloves should be replaced immediately if signs of degradation are observed. Breakthrough time not determined as preparation, consult PPE manufacturers.

SKIN PROTECTION :
When handling this product, the use of overalls, a chemical resistant apron and rubber boots is recommended. A full slicker suit is recommended if gross exposure is possible.

EYE PROTECTION :
Wear chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Dark Amber
ODOR	None

SPECIFIC GRAVITY	1.33 - 1.37 @ 77 °F / 25 °C
DENSITY	11.39 lb/gal
SOLUBILITY IN WATER	Complete
pH (100 %)	0.5
VOC CONTENT	0 % Calculated

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Extremes of temperature

MATERIALS TO AVOID :
Bases Contact with strong alkalies (e.g. ammonia and its solutions, carbonates, sodium hydroxide (caustic), potassium hydroxide, calcium hydroxide (lime), cyanide, sulfide, hypochlorites, chlorites) may generate heat, splattering or boiling and toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: Oxides of sulfur, Oxides of nitrogen, Oxides of carbon

11. TOXICOLOGICAL INFORMATION

No toxicity studies have been conducted on this product.

SENSITIZATION :
This product is not expected to be a sensitizer.

CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: Moderate

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the product, unless otherwise indicated.

Acute Fish Results :

Species	Exposure	Test Type	Value	Test Descriptor
Rainbow Trout	96 hrs	LC50	6.4 mg/l	Product
Fathead Minnow	96 hrs	LC50	37 mg/l	Product

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Daphnia magna	48 hrs	LC50	230 mg/l	Product

CHRONIC FISH RESULTS :

Species	Exposure	Test Type	Value	End Point	Test Descriptor
Fathead Minnow	7 d	EC25 / IC25	13.6 mg/l	Growth	Product
Fathead Minnow	7 d	NOEC	13 mg/l	Growth	Product
Fathead Minnow	7 d	LOEC	25 mg/l	Growth	Product

PERSISTENCY AND DEGRADATION :

Chemical Oxygen Demand (COD) : 2,090 mg/l

Biological Oxygen Demand (BOD) :

Incubation Period	Value	Test Descriptor
5 d	0 mg/l	Product

The organic portion of this preparation is expected to be poorly biodegradable.

MOBILITY :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	30 - 50%	50 - 70%

The portion in water is expected to be soluble or dispersible.

BIOACCUMULATION POTENTIAL
This preparation or material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Moderate

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it could meet the criteria of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Before disposal, it should be determined if the waste meets the criteria of a hazardous waste.

Hazardous Waste: D002

Hazardous wastes must be transported by a licensed hazardous waste transporter and disposed of or treated in a properly licensed hazardous waste treatment, storage, disposal or recycling facility. Consult local, state, and federal regulations for specific requirements.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

The presence of an RQ component (Reportable Quantity for U.S. EPA and DOT) in this product causes it to be regulated with an additional description of RQ for road, or as a class 9 for road and air, ONLY when the net weight in the package exceeds the calculated RQ for the product.

LAND TRANSPORT :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Technical Name(s) :	FERRIC SULFATE
UN/ID No :	UN 3264
Hazard Class - Primary :	8
Packing Group :	III
Flash Point :	> 200 F/ > 93.3 °C
Reportable Quantity (per package) :	2,850 lbs
RQ Component :	FERRIC SULFATE

AIR TRANSPORT (ICAO/IATA) :

The presence of an RQ component (Reportable Quantity for U.S. EPA and DOT) in this product causes it to be regulated with an additional description of RQ for road, or as a class 9 for road and air, ONLY when the net weight in the package exceeds the calculated RQ for the product.

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Technical Name(s) :	FERRIC SULFATE
UN/ID No :	UN 3264
Hazard Class - Primary :	8
Packing Group :	III
Reportable Quantity (per package) :	2,850 lbs
RQ Component :	FERRIC SULFATE

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Technical Name(s) :	FERRIC SULFATE
UN/ID No :	UN 3264
Hazard Class - Primary :	8
Packing Group :	III

15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

Ferric Sulfate : Eye irritant

CERCLA/SUPERFUND, 40 CFR 302 :
This product contains the following Reportable Quantity (RQ) Substance. Also listed is the RQ for the product. If a reportable quantity of product is released, it requires notification to the NATIONAL RESPONSE CENTER, WASHINGTON, D.C. (1-800-424-8802).

RQ Substance	RQ
Ferric Sulfate	2,850 lbs

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
	Delayed (Chronic) Health Hazard
	Fire Hazard
	Sudden Release of Pressure Hazard
	Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

NSF INTERNATIONAL :
This product has received NSF/International certification under NSF/ANSI Standard 60 in the coagulation and flocculation category. The official name is "Polymer Blends." Maximum product application dosage is : 150 mg/l.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
This product contains the following substances listed in the regulation. Additional components may be unintentionally present at trace levels.

Substance(s)	Citations
• Ferric Sulfate • Sulfuric Acid	Sec. 311

CLEAN AIR ACT, Sec. 112 (Hazardous Air Pollutants, as amended by 40 CFR 63), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CALIFORNIA PROPOSITION 65 :
Substances listed under California Proposition 65 are not intentionally added or expected to be present in this product.

MICHIGAN CRITICAL MATERIALS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

STATE RIGHT TO KNOW LAWS :
The following substances are disclosed for compliance with State Right to Know Laws:

Ferric Sulfate 10028-22-5

INTERNATIONAL CHEMICAL CONTROL LAWS :

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

NEW ZEALAND
All substances in this product comply with the Hazardous Substances and New Organisms (HSNO) Act 1996,and are listed on or are exempt from the New Zealand Inventory of Chemicals.

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),
Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight™ (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date issued : 05/07/2012
Version Number : 1.12

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Boiler Chemical Additives

- Manufacturers Product Identification Number: **Nalclear 7768**
- Product Use: **Flocculant for raw water treatment**
- Chemical Composition: **Proprietary**
- Classification (non-persistent, persistent or bioaccumulative): **Not Available**
- Product or active ingredient half-life: **Not Available**
- Frequency of product use: **Intermittent use as needed**
- Product toxicity data: **See attached data sheets**
- Concentration of whole product or active ingredient in wastestream: **Not Available**
- Outfall: **101**

NALCO

SAFETY DATA SHEET

PRODUCT

NALCLEAR® 7768

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : NALCLEAR® 7768

APPLICATION : FLOCCULANT

COMPANY IDENTIFICATION : Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 0 / 1 FLAMMABILITY : 1 / 1 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

CAUTION
May cause irritation with prolonged contact.
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Keep container tightly closed. Water in contact with the product will cause slippery floor conditions. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water. Use a mild soap if available. Protect product from freezing.
Wear suitable protective clothing.
Phase separation of the product may occur after prolonged storage. The top phase will be combustible hydrocarbon solvent. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of nitrogen (NOx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
May cause irritation with prolonged contact.

SKIN CONTACT :
Frequent or prolonged contact with product may defat and dry the skin, leading to discomfort and dermatitis.

INGESTION :
Not a likely route of exposure. If swallowed a jelly mass may form which in digestion may cause blockage.

INHALATION :
Not a likely route of exposure. Repeated or prolonged exposure may irritate the respiratory tract.

SYMPTOMS OF EXPOSURE :
Acute :
A review of available data does not identify any symptoms from exposure not previously mentioned.
Chronic :
Frequent or prolonged contact with product may defat and dry the skin, leading to discomfort and dermatitis.

AGGRAVATION OF EXISTING CONDITIONS :
A review of available data does not identify any worsening of existing conditions.

4. FIRST AID MEASURES

EYE CONTACT :
Wipe or blot away excess material with clean cloth or paper towel. Wash affected areas thoroughly with water. If symptoms develop, seek medical advice.

SKIN CONTACT :
Wipe or blot away excess material with clean cloth or paper towel. Wash affected areas thoroughly with water. Use a mild soap if available. If symptoms develop, seek medical advice.

INGESTION :
Do not induce vomiting without medical advice. Get medical attention.

INHALATION :
Remove to fresh air, treat symptomatically. If symptoms develop, seek medical advice.

NOTE TO PHYSICIAN :
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT : > 200 °F / > 93.3 °C (PMCC)

EXTINGUISHING MEDIA :
Foam, Dry powder, Carbon dioxide, Other extinguishing agent suitable for Class B fires

UNSUITABLE EXTINGUISHING MEDIA :
Do not use water unless flooding amounts are available.

FIRE AND EXPLOSION HAZARD :
Phase separation of the product may occur after prolonged storage. The top phase will be combustible hydrocarbon solvent. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of nitrogen (NOx) under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Keep people away from and upwind of spill/leak. Ventilate spill area if possible. Spill may be slippery.

METHODS FOR CLEANING UP :
SMALL SPILLS: Water in contact with the product will create a voluminous, slippery gel. Soak up as thoroughly as possible with inert absorbent material or sawdust. Do NOT hose down area until all possible traces of polymer are removed. LARGE SPILLS: Water in contact with the product will cause slippery floor conditions. Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Clean contaminated surfaces with water or aqueous cleaning agents. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
Prevent material from entering sewers or waterways.

7. HANDLING AND STORAGE

HANDLING :
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Do not breathe vapors/gases/dust. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled. Stir well prior to use.

STORAGE CONDITIONS :
Store separately from oxidizers. Store the containers tightly closed. Store in suitable labeled containers. Protect product from freezing.

SUITABLE CONSTRUCTION MATERIAL :
Hastelloy C-276, Stainless Steel 316L, Stainless Steel 304, Plasite 7122, Inconel 625, Plasite 4300, CPVC (rigid), Polypropylene (rigid), Polyethylene (rigid), PTFE, Fluoroelastomer

UNSUITABLE CONSTRUCTION MATERIAL :
Brass, Neoprene, Buna-N, Natural rubber, Polyurethane, EPDM, Mild steel, Galvanized metals, Polyethylene tubing, Chlorosulfonated polyethylene rubber

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
This product does not contain any substance that has an established exposure limit.

ENGINEERING MEASURES :
General ventilation is recommended. Use local exhaust ventilation if necessary to control airborne mist and vapor.

RESPIRATORY PROTECTION :
Where concentrations in air may exceed the limits given in this section or when significant mists, vapors, aerosols, or dusts are generated, an approved air purifying respirator equipped with suitable filter cartridges is recommended. Consult the respirator / cartridge manufacturer data to verify the suitability of specific devices. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
When handling this product, the use of chemical gloves is recommended. The choice of work glove depends on work conditions and what chemicals are handled. Please contact the PPE manufacturer for advice on what type of glove material may be suitable. Gloves should be replaced immediately if signs of degradation are observed.

SKIN PROTECTION :
Wear standard protective clothing.

EYE PROTECTION :
Wear safety glasses with side-shields.

HYGIENE RECOMMENDATIONS :
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

HUMAN EXPOSURE CHARACTERIZATION :
Based on our recommended product application and personal protective equipment, the potential human exposure is:
Moderate

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Emulsion
APPEARANCE	Off-white
ODOR	Slight, Hydrocarbon
SPECIFIC GRAVITY	1.04 @ 77 °F / 25 °C

DENSITY	8.55 - 9.05 lb/gal
SOLUBILITY IN WATER	Emulsifiable
pH (1 %)	6.8
VISCOSITY	200 - 1,700 cps @ 77 °F / 25 °C
FREEZING POINT	26 °F / -3 °C
BOILING POINT	215 °F / 102 °C
VOC CONTENT	26.2 % EPA Method 24

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Freezing temperatures.

MATERIALS TO AVOID :
Addition of water results in gelling. Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: Oxides of carbon, Oxides of nitrogen

11. TOXICOLOGICAL INFORMATION

No toxicity studies have been conducted on this product.

SENSITIZATION :
This product is not expected to be a sensitizer.

CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: Low

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the product, unless otherwise indicated.

Acute Fish Results :

Species	Exposure	Test Type	Value	Test Descriptor
Sheepshead Minnow	96 hrs	LC50	> 1,000 mg/l	1% Aqueous Solution of a Similar Product
Rainbow Trout	96 hrs	LC50	8,500 mg/l	1% Aqueous Solution of Product
Inland Silverside	96 hrs	LC50	90.7 mg/l	Product
Rainbow Trout	96 hrs	LC50	157.5 mg/l	Product

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Mysid Shrimp (M. litoralis)	96 hrs	LC50	188.9 mg/l	Product
Mysid Shrimp (Mysidopsis bahia)	96 hrs	LC50	67.4 mg/l	Product
Daphnia magna	48 hrs	LC50	0.694 mg/l	Product
Daphnia magna	48 h	EC50	2.0 mg/l	Tested with 20 mg/L Humic Acid

AQUATIC PLANT RESULTS :

Species	Exposure	Test Type	Value	Test Descriptor
Marine Algae (Skeletonema costatum)	72 hrs	EC50	23 mg/l	Product

PERSISTENCY AND DEGRADATION :

Chemical Oxygen Demand (COD) : 429,000 mg/l

Biological Oxygen Demand (BOD) :

Incubation Period	Value	Test Descriptor
5 d	200,000 mg/l	Product

The organic portion of this preparation is expected to be inherently biodegradable.

MOBILITY :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
5 - 10%	30 - 50%	50 - 70%

The portion in water is expected to be soluble or dispersible.

BIOACCUMULATION POTENTIAL
This preparation or material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low
Based on our recommended product application and the product's characteristics, the potential environmental exposure is: Moderate

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous waste, it is not subject to federal regulation. Consult state or local regulation for any additional handling, treatment or disposal requirements. For disposal, contact a properly licensed waste treatment, storage, disposal or recycling facility.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.

CERCLA/SUPERFUND, 40 CFR 302 :
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FOOD AND DRUG ADMINISTRATION (FDA) Federal Food, Drug and Cosmetic Act :
When use situations necessitate compliance with FDA regulations, this product is acceptable under : 21 CFR 176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods., 21 CFR 173.315 chemicals used in washing or to assist in the lye peeling of fruits and vegetables

Maximum product dosage is 0.345% of finished paper or paperboard. 21 CFR 173.315 Limitation: For use only in the washing of sugar beets as a flume mud dewatering aid applied to the underflow of the final flume water clarifier just prior to the flume mud belt press at maximum concentration of 500 ppm as product.

NSF INTERNATIONAL :
This product has received NSF/International certification under NSF/ANSI Standard 60 in the coagulation and flocculation category. The official name is "Polyacrylamide." Maximum product application dosage is : 1 mg/l.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
This product may contain trace levels (<0.1% for carcinogens, <1% all other substances) of the following substance(s) listed under the regulation. Additional components may be unintentionally present at trace levels.

Substance(s)	Citations
Cupric Sulphate	Sec. 307, Sec. 311

CLEAN AIR ACT, Sec. 112 (Hazardous Air Pollutants, as amended by 40 CFR 63), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
This product may contain trace levels (<0.1% for carcinogens, <1% all other substances) of the following substance(s) listed under the regulation. Additional components may be unintentionally present at trace levels.

Substance(s)	Citations
Acrylamide	Sec. 112

CALIFORNIA PROPOSITION 65 :
This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels, which would require a warning under the statute.

MICHIGAN CRITICAL MATERIALS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

STATE RIGHT TO KNOW LAWS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

INTERNATIONAL CHEMICAL CONTROL LAWS :

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

NEW ZEALAND
All substances in this product comply with the Hazardous Substances and New Organisms (HSNO) Act 1996,and are listed on or are exempt from the New Zealand Inventory of Chemicals.

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: Low

* The environmental risk is: Low

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),
Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight™ (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date issued : 01/27/2012
Version Number : 1.30

Attachment H

Once – Through Cooling Chemical Additives

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Attachment L

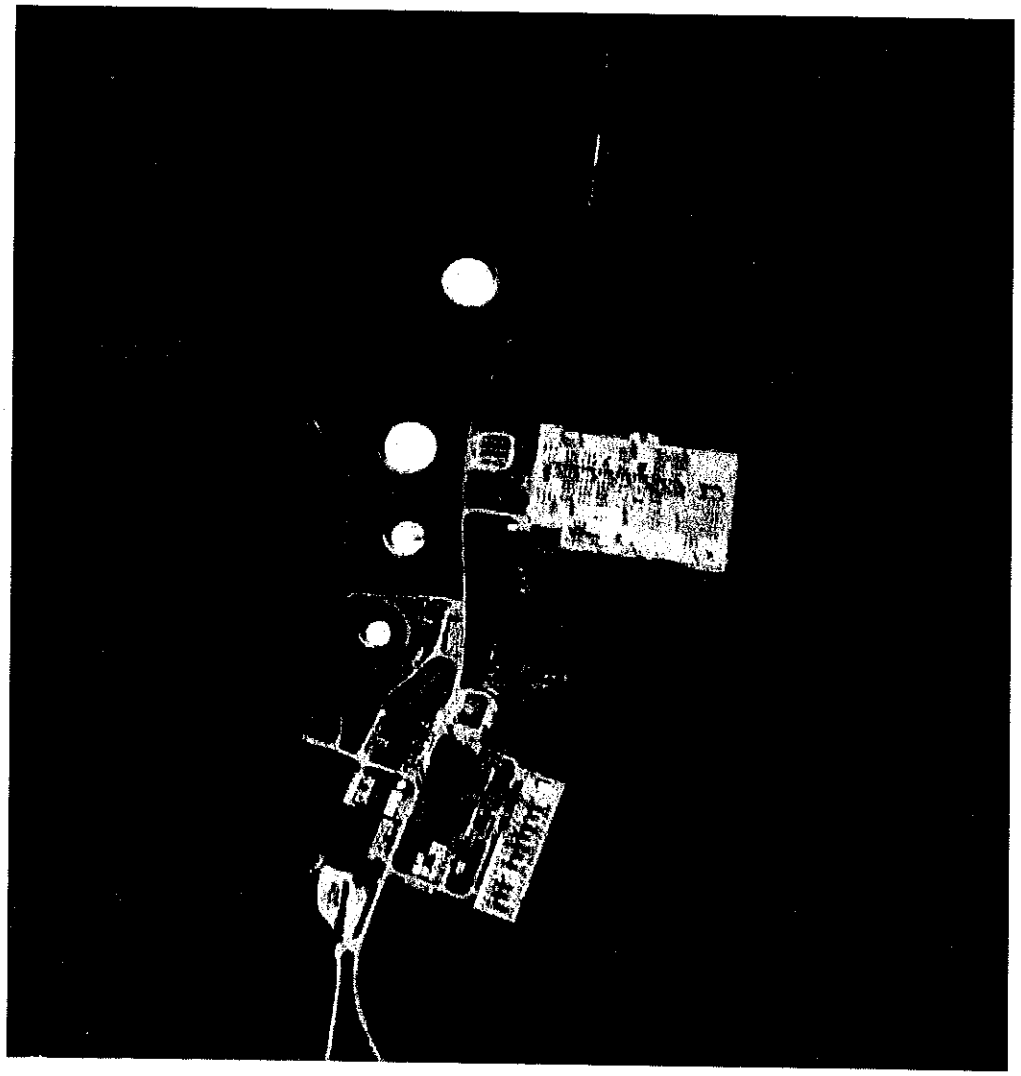
Lake Hubbard Steam Electric Station
§ 316(b) Information to Inform the Entrainment BTA Determination and Select the Chosen Method of Compliance for Impingement BTA

Final Report, August 2018

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Lake Hubbard Steam Electric Station § 316(b) § 122.21(r)(2)-(8) and § 125.98(f) Information to Inform the Entrainment BTA Determination and Select the Chosen Method of Compliance for Impingement BTA

Final Report, March 2019



ACKNOWLEDGMENTS

The Electric Power Research Institute (EPRI) prepared this report will the assistance of the following individuals and organizations, under contract to the Electric Power Research Institute (EPRI):

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Acronyms

AIF – Actual Intake Flow

BPJ – Best Professional Judgement

BTA - Best Technology Available

CCRS – Closed-cycle Recirculating System

cfs – Cubic Feet per Second

CWA – Clean Water Act

CWIS – Cooling Water Intake Structure

ERCOT – Electric Reliability Council of Texas

EPA - United States Environmental Protection Agency

LHSES – Lake Hubbard Steam Electric Station

MGD – Million Gallons per Day

MDCT – Mechanical Draft Cooling Tower

NPDES – National Pollution Discharge Elimination System

ppt – parts per thousand

TCEQ – Texas Commission on Environmental Quality

T&E – Threatened and Endangered

TPDES – Texas Pollution Discharge Elimination System

TPWD – Texas Parks and Wildlife Department

USFWS – United States Fish and Wildlife Service

EXECUTIVE SUMMARY

This document is submitted in compliance with U.S. Environmental Protection Agency (EPA) final § 316(b) regulations (Rule) for existing facilities that became effective on October 14, 2014 for Luminant's Lake Hubbard Steam Electric Station (LHSES). The three objectives of this document are to:

1. Provide the § 122.21(r)(2) through (8) information,
2. Provide the Texas Commission on Environmental Quality (TCEQ) with information to support the entrainment best technology available (BTA) determination required by the permitting authority at § 125.98(f) of the Rule.
3. Formalize the chosen method of compliance for impingement required at § 122.21(r)(6) of the Rule.

The Rule requires all facilities using >2 MGD to employ or install BTA to reduce entrainment and impingement mortality. All facilities are required to submit the § 122.21(r)(2) and (3) information and applicable provisions of the (r)(4) through (8) information for impingement that includes:
(r)(2) – Source Water Physical Data
(r)(3) – Cooling Water Intake Structure Data
(r)(4) – Source Water Baseline Biological Characterization Data
(r)(5) – Cooling Water System Data
(r)(6) – Chosen Method of Compliance with the Impingement Mortality Standard
(r)(7) – Entrainment Performance Studies
(r)(8) – Operational Status

For facilities that withdraw >125 million gallons per day (MGD) of actual cooling water flow (AIF) are required to submit entrainment information that includes the § 122.21(r)(9) - (12) information as follows:

- (9) – Entrainment Characterization Study
- (10) – Comprehensive Technical Feasibility and Cost Evaluation Study
- (11) – Benefits Valuation Study
- (12) – Non-water Quality Environmental and Other Impacts Study

However, the Rule at § 125.95(a)(3) includes a provision that states: "*The Director may waive some or all of the information requirements of 40 CFR 122.21(r) if the intake is located in a manmade lake or reservoir and the fisheries are stocked and managed by a State or Federal natural resources agency or the equivalent. If the manmade lake or reservoir contains Federally-listed threatened and endangered species, or is designated critical habitat, such a waiver shall not be granted*".

LHSES withdraws cooling water from a man-made lake (Lake Hubbard Reservoir) and the fisheries are stocked and managed by the Texas Parks and Wildlife Department (TPWD). Luminant submitted a request to the Texas Department of Environmental Quality (TCEQ) in a

letter dated August 17, 2015 to grant an information waiver for the § 122.21(r)(2) - (13) information for LHSES based on withdrawal from a freshwater reservoir with a stocked and managed fishery). Since the AIF for LHSES is <125 MGD (i.e., AIF for 2016-2018 was 119.9 mgd) and additionally Luminant is providing to support that LHSES qualifies for an exemption from some or all of the information at § 122.21(r)(9) - (13) by virtue of withdrawing cooling water from a man-made reservoir with a stocked and managed fishery (see Chapter 9). However, Luminant is not required to provide the entrainment information at § 122.21(r)(9) - (13) for LHSES, TCEQ is still required to make an entrainment information at § 125.98(f) of the Rule. TCEQ is also requiring all facilities actively withdrawing cooling water to provide the § 122.21(r)(2) - (8) information. The objective of this document is to provide TCEQ with the following:

1. The § 122.21(r)(2) - (8) information for LHSES,
2. Provide information to support TCEQ's entrainment BTA determination, and
3. Luminant's chosen method of compliance to satisfy the impingement mortality reduction BTA requirements.

Information Provided to Support the Entrainment BTA Determination

Relative to providing information to assist TCEQ in the entrainment BTA determination, Section 10 of this document provides information on the factors that the agency must and may consider at § 125.98(f) of the Rule. A summary of key considerations includes:

- Based on information provided in Appendix B and Texas Parks and Wildlife 2015 Ray Hubbard Reservoir Monitoring Survey Report (Appendix C). There is no mention of negative impacts from the operation of LHSES in the TPWD monitoring report.
- There are no federally threatened or endangered species nor designated critical habitat for such species at risk in the Lake Hubbard Reservoir from LHSES's cooling water intake structure (CWIS) operations.
- While not required, three entrainment fish protection technologies were evaluated consistent with § 122.21(r)(10)(i) of the Rule that included retrofit of a CCRS using mechanical draft cooling towers, fine-mesh screens and an alternative source of cooling water with the following results:
    - Retrofit with a mechanical draft CCRS is estimated to cost between $102.4 and $322.5 million
    - Two types of fine-mesh screens were evaluated that included fine-mesh modified traveling screens estimated to cost in excess of $10.9 million and narrow-slot wedgewire screens (an exclusion technology) that were estimated to have a capital cost of over $33 million for a 0.5 mm slot size and approximately $16.4 million for a 2.0 mm slot size.
    - An alternative water supply source was deemed infeasible for LHSES.
    - Given the magnitude of the estimated capital cost and LHSES's capacity utilization over the past five years of 8.5%, if any of these entrainment reduction technologies were required the facility would most likely be retired.
    - Capital cost generally makes up in excess of 75% of the social cost and additional social cost would include loss of tax revenue to the local economy, loss of jobs at the facility and loss of the purchase of goods and services by the facility from the

local community in addition to an increase in electric prices since more costly generation would be necessary to replace power should LHSES retire.

- In terms of biological benefits of the evaluated technologies, all are expected to have cost that are wholly disproportional to their benefits considering:
    - TCEQ has already acknowledged that LHSES uses a CCRS as defined at § 125.92(c)(2) of the Rule and regarding that technology the EPA states *"Closed-cycle cooling is indisputably the most effective technology at reducing entrainment."* (pg. 48342, column 1, 14 lines from bottom of the page).
    - Actual intake flow (AIF) over the past three years has averaged just under 119.9 MGD. This represents 19.4% of the design intake flow that is a significant flow reduction and is the result of a new practice to only operate cooling water pumps when electric power is being generated.
    - The current overall health of the Lake Hubbard fishery relative to estimated technology costs and current LHSES operations.

The above considerations support a determination that the existing CWIS at LHSES is BTA for entrainment that is consistent with § 125.98(f)(4) of the Rule, where it states *"The Director may reject an otherwise available technology as a BTA standard for entrainment if the social costs are not justified by the social benefits."* and *"the Director may determine that no additional control requirements are necessary beyond what the facility is already doing."*

Chosen Method of Compliance for Impingement BTA

As discussed in Section 6 of this document, for LHSES, Luminant selects use of a CCRS at § 125.94(c)(1) of the Rule and TCEQ's September 2, 2015 letter to Luminant approved use of the CCRS for impingement BTA.

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LIST OF FIGURES

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1 INTRODUCTION

The purpose of this document is to provide TCEQ with information to support a site-specific entrainment BTA determination for Luminant's LHSES to comply with § 316(b) of the Clean Water Act (CWA). The introduction consists of three sections that include a general overview of the Rule, a brief discussion of the compliance approach for LHSES and a summary of the organization of the remainder of this document.

General §316(b) Rule Overview

The U.S. Environmental Protection Agency (USEPA) issued the Rule for existing facilities that became effective on October 14, 2014. These regulations require all facilities using >2 MGD to install best technology available (BTA) for entrainment and impingement at cooling water intake structures (CWIS). All facilities are required to submit the § 122.21(r)(2) and (3) information and applicable provisions of the (r)(4) through (8) information for impingement that includes:
(r)(2) – Source Water Physical Data
(r)(3) – Cooling Water Intake Structure Data
(r)(4) – Source Water Baseline Biological Characterization Data
(r)(5) – Cooling Water System Data
(r)(6) – Chosen Method of Compliance with the Impingement Mortality Standard
(r)(7) – Entrainment Performance Studies
(r)(8) – Operational Status

The BTA determination for entrainment is based on information provided to the National Pollution Discharge Elimination System (NPDES) permitting authority (TCEQ for LHSES). The BTA determination for entrainment is made on a site-specific basis. At a minimum, all facilities using >125 MGD actual intake flow (AIF) are required to submit entrainment information that includes the § 122.21(r)(9) - (12) information as follows:

- (9) – Entrainment Characterization Study
- (10) – Comprehensive Technical Feasibility and Cost Evaluation Study
- (11) – Benefits Valuation Study
- (12) – Non-water Quality Environmental and Other Impacts Study

However, Rule provides a provision at § 125.95(a)(3) that allows TCEQ to waive some or all of the §122.21(r) information requirements if the facility is located on a manmade lake or reservoir with a stocked and managed fishery. While TCEQ can waive the § 122.21(r) information, it is still required to make a site-specific BTA determination for entrainment as required at § 125.98(f) of the Rule. Once the BTA determination for entrainment is made, the facility must select from one of seven alternatives to reduce impingement mortality. The seven impingement mortality BTA alternatives include:

1. Closed-cycle Cooling Recirculating System (CA1)

2. 0.5 fps Through-Screen Design Velocity (CA2)
3. 0.5 fps Through-Screen Actual Velocity (CA3)
4. Existing Offshore Velocity Cap (CA4)
5. Modified Traveling Screens (CA5)
6. System of Technologies as the BTA for Impingement Mortality (CA6)
7. Impingement Mortality Performance Standard (CA7)

However, the Rule includes a number of potential exemptions that include:

- a *de minimis* exemption for *de minimis* levels of impingement,
- a provision for less stringent standards for low capacity utilization,
- an exemption from use of technologies at nuclear facilities that conflict with federal nuclear safety requirements.

The Rule provides broad discretionary authority to TCEQ to deny exemptions or even impose additional requirements, especially if federally protected threatened or endangered species or their designated critical habitat are at risk.

Compliance Approach for Lake Hubbard Steam Electric Station

The compliance approach for LHSES is as follows:

1. Per TCEQ's § 316(b) requirements, this document provides the § 122.21(r)(2) – (8) information for LHSES.
2. Provide TCEQ with information to support the entrainment BTA determination for LHSES as specified at § 125.98(f) of the Rule.
3. Select the chosen method or compliance for impingement BTA.

Report Organization

The report is organized into ten chapters. Following this Introduction, Chapters 2 through 8 provide the § 122.21(r)(2) – (8) information respectively. Chapter 9 provides information to support TCEQ's site-specific entrainment BTA determination and Chapter and Chapter 10 provides references used in the document. Also attached are the following Appendices:
Appendix A –TCEQ's letter of approval that the Lake Hubbard Reservoir qualified as a CCRS
Appendix B – LHSES Source Waterbody Biological Information
Appendix C - Lake Hubbard 2015 Fisheries Management Report (most recent)
Appendix D – Evaluation of Fine-mesh Screens for LHSES

2 SOURCE WATERBODY INFORMATION

This chapter provides the source waterbody information for LHSES required at § 122.21(r)(2) of the Rule. Below each of the three subsections required is stated followed by either the required information for LHSES or where that information can be located in other LHSES submittals Luminant has provided to TCEQ.

(i) A narrative description and scaled drawings showing the physical configuration of all source water bodies used by your facility, including areal dimensions, depths, salinity and temperature regimes, and other documentation that supports your determination of the water body type where each cooling water intake structure is located:

Narrative Description with Scaled Drawing, Areal Dimensions and Depths

The physical configuration of Lake Hubbard and the location of LHSES is shown in Figure 2-1 and larger view of the LHSES CWIS is shown in Figure 2-2. Lake Hubbard's areal dimensions and depths were found at:
http://www.twdb.texas.gov/surfacewater/rivers/reservoirs/ray_hubbard/index.asp and are provided below.

"Lake Ray Hubbard (also known as Rockwall-Forney Dam), formerly Forney Lake, is located just north of Forney about fifteen miles east of Dallas and extended in the counties of Dallas, Kaufman, Collin, and Rockwall, on the East Fork Trinity River, a tributary of the Trinity River. The dam is currently owned by the City of Dallas and operated by Dallas Water Utilities, a not-for-profit department of the City of Dallas for purposes of municipal and industrial water supply, flood control and recreation.

The Lake was originally named Forney Lake for the nearby town of Forney. After the City of Dallas incorporated the lake, it was renamed after a living person, Ray Hubbard, who presided over the Dallas Parks and Recreation System board from 1943 to 1972. Permit was issued on March 6, 1959 and land was purchased on September 17, 1963 for the reservoir where originally was a small lake named Corder Lake. Construction of the dam was started on June 13, 1964 by general contractors, the S. and A. Construction Company and the Markham, Brown and M. C. Winter Construction Company. The Dam was closed in September, 1967 and deliberate impoundment began on December 1, 1968.

The Dam of a two-mile earth-fill embankment having top elevation of 450 feet above mean sea level was finally completed on January, 1969. The spillway is concrete ogee weir controlled by 14 tainter gates, each 40 feet wide and 28 feet tall, with a crest of 560 feet net length at elevation of 409.5 feet above mean sea level. By 1970 the lake reached its maximum design extent. At top of flood control gates or emergency spillway, elevation of 437.5 feet above mean sea level, the Lake can store 540,000 acre feet of water encompassing a surface area of 24,000 acres. Lake Ray Hubbard features a lakeside power plant named for its proximity to the lake. The Lake Ray

Hubbard Steam Electric Station, a TXU power plant, is a two-unit gas/oil fired power plant that has been operating since June 8, 1970 and November 20, 1973. According to TWDB 2015 survey, at top of conservation pool elevation, 435.5 feet above mean sea level, the lake measures 20,947 acres of water surface with a storage capacity of 439,559 acre-feet and a maximum depth of about 40 feet. The Dam control a drainage area of about 1,074 square miles of which 770 square miles are above Lavon Lake."

In terms of depth, the internet at:
https://www.google.com/search?ei=e8mHXILoLYPIsQXPtafgCg&q=Water+depth+of+lake+hubbard+in+texas&oq=Water+depth+of+lake+hubbard+in+texas&gs_l=psy-ab.3...33735.41091..42705...1.0..1.330.2965.0j17j0j2.....0....1..gws-wiz.....0i71j35i304i39.xxYCSdeMrr8 reports the maxim depth of Lake Hubbard as 40 ft.

"According to TWDB 2015 survey, at top of conservation pool elevation, 435.5 feet above mean sea level, the lake measures 20,947 acres of water surface with a storage capacity of 439,559 acre-feet and a maximum depth of about 40 feet."

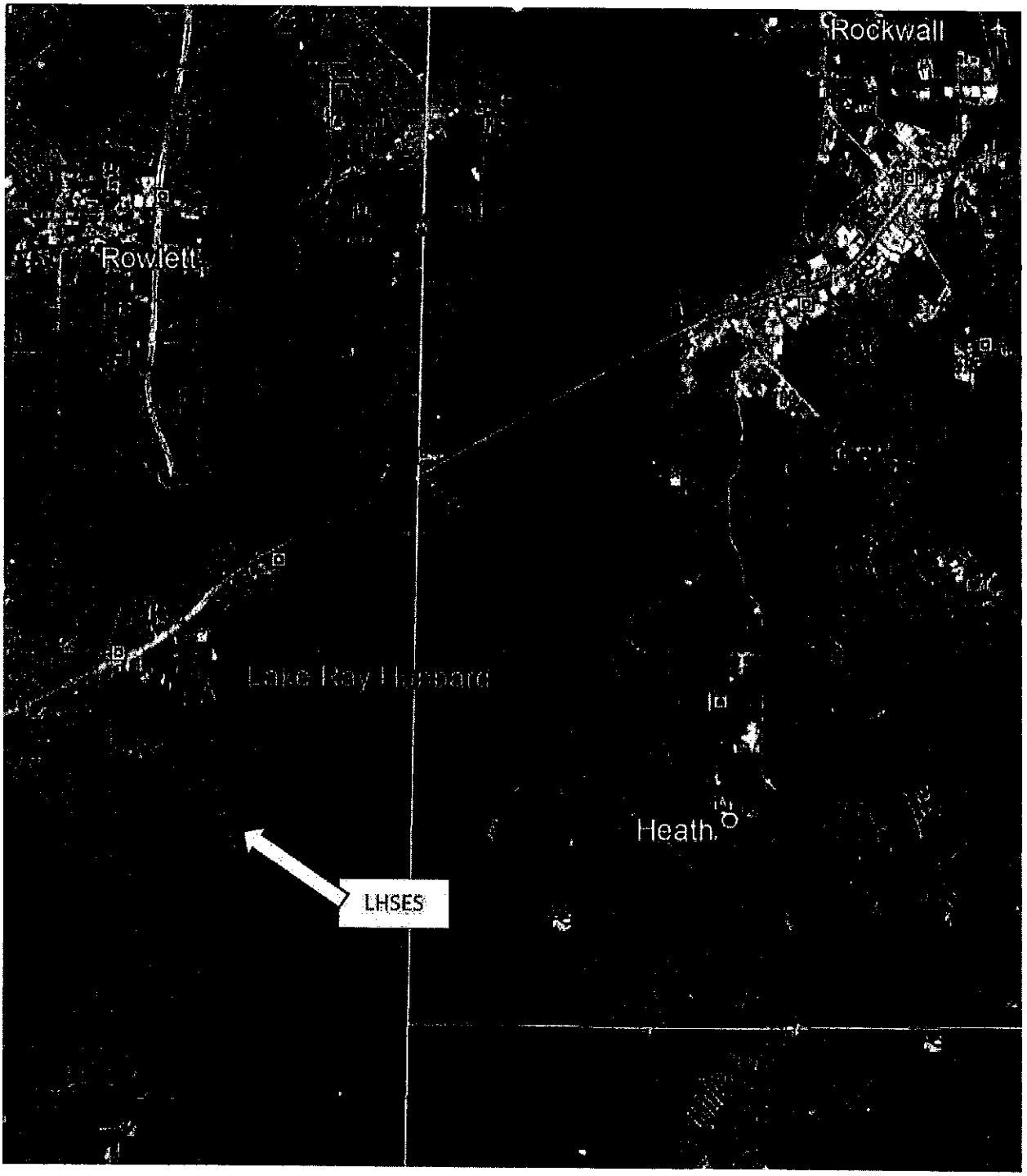

Figure 2-1. Ariel view of Lake Hubbard

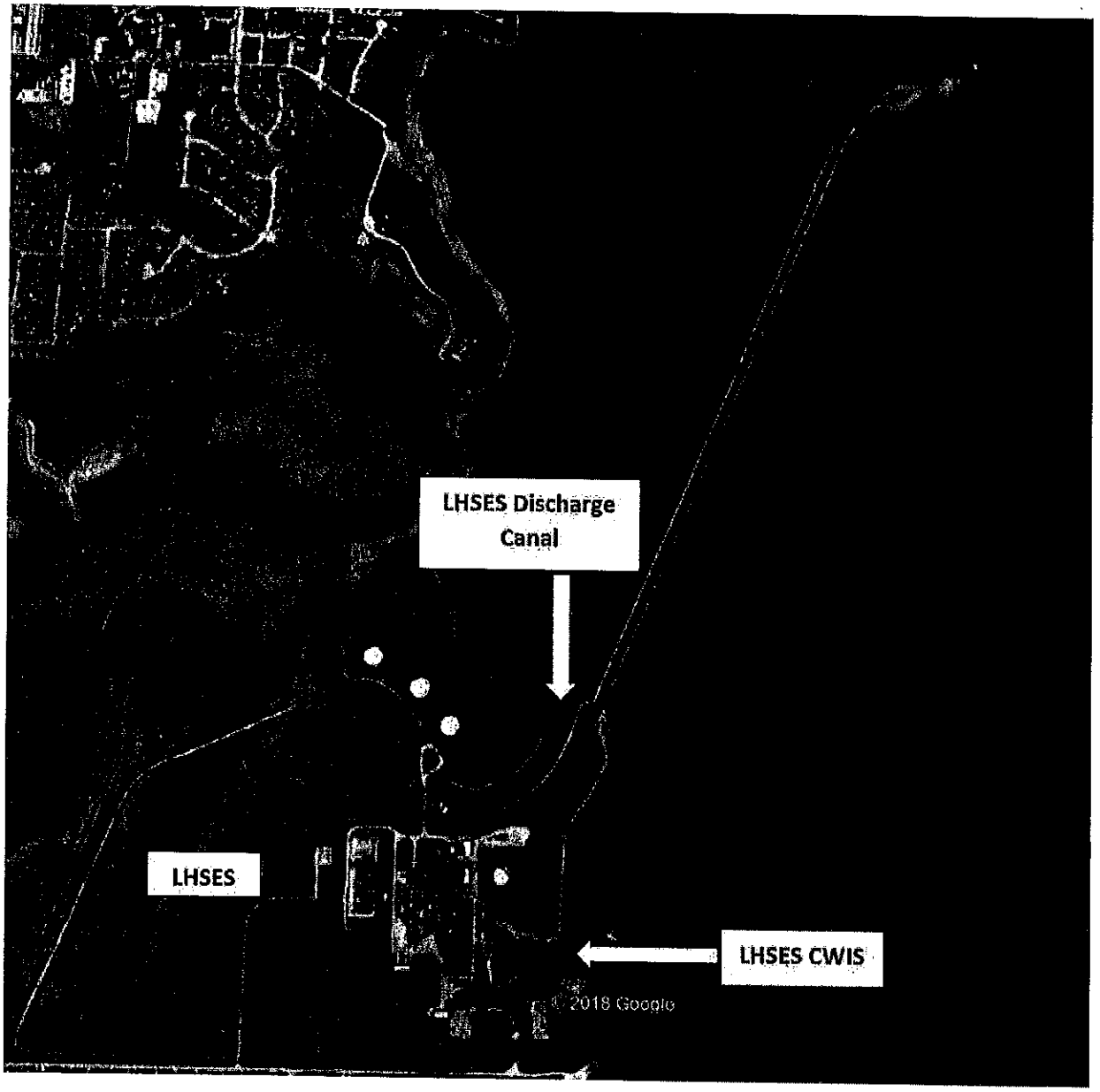

Figure 2-2. Ariel of LHSES CWIS on Lake Hubbard.

Salinity

Lake Hubbard Reservoir is a freshwater waterbody with salinities <1 ppt.

Temperature

Luminant is not required to monitor or record water temperature at the intake structure. However, water temperature before the heat exchangers is monitored as an operational parameter for the plant operation. It is collected only as collateral information that is not vetted or strictly recorded and does not utilize calibrated thermometers.

Luminant reviewed four years of the available uncalibrated intake temperature data (2015-2018; while the data set was not complete for every day the review found the high intake temperature found was 85° F, on Aug 10, 2015, and the low temperature was 48°F on Feb 20, 2018. Based on operational knowledge, those temperatures are typical, and representative of the range experienced over similar periods.

(ii) Identification and characterization of the source waterbody's hydrological and geomorphological features, as well as the methods you used to conduct any physical studies to determine your intake's area of influence within the waterbody and the results of such studies. - Information on Lake Hubbard Reservoir's hydrological and geomorphological features were provided in the narrative description above. Luminant did not conduct any physical studies to determine LHSES's intake's area of influence within the waterbody.

(iii) Locational maps – Provided in Figure 2-1 and 2-2.

3 CWIS INFORMATION

The Rule at § 122.21(r)(3) requires Luminant to provide the following cooling water intake information for LHSES. Each of the five subsections is listed below and followed by either the information or where the information can be found in other documents provided to TCEQ by Luminant for LHSES

(i) A narrative description of the configuration of each of your cooling water intake structures and where it is located in the water body and in the water column:

LHSES is located on Lake Hubbard, near Sunnyvale, Texas. Figures 2-1 and 2-2 provide aerial photographs showing LHSES's location on the reservoir as well as the location of the CWIS. The facility has two units that use once-through cooling. Unit 1 generates 393 MW and Unit 2 generates 528 MW. Unit 1 has two intake bays and Unit 2 has three intake bays. Each bay has a traveling water screen, a trash rack, coarse-mesh fixed screen, and circulating water pump. The intake canal entrance has an invert at El. 399.0 ft at the entrance and slopes down to El. 391.0 ft at the face of the intake. The CWIS for Units 1 and 2 is about 91 ft wide with an invert at El. 391.0 ft. Trash racks are located at the front of the intake and have 3/8 in. by 3 in. bars spaced 2.5 in. on center. Traveling water screens are located about 12 ft downstream of the trash racks. Each screen is 10 ft wide with a 1/4 in square mesh. The screens are rotated at 11.3 ft/min. Trash and debris are removed from the screens using a front spraywash system. Coarse-mesh fixed screens are located about 10 ft downstream of the traveling water screens and are 11.2 ft wide with a 3/8 square mesh. Circulating water pumps are located about 14 ft downstream of the coarse-mesh fixed screens. The circulating water flow for Unit 1 pumps are each rated at 206 cfs and the circulating water pumps for Unit 2 are each rated at 245 cfs producing a total plant flow of 1,148 cfs (617.8 mgd). At conservation pool level (El. 435.5 ft) and full flow conditions the velocity in the intake canal is about 0.13 ft/sec directly in front of the screenhouse and increases to a velocity of 0.16 ft/sec at the canal entrance, about 150 ft in front of the screenhouse. Velocities approaching the traveling screens were also calculated independently for each unit. These velocities were calculated under full hydraulic conditions and conservation pool level. With Unit 1 withdrawing 412 cfs the velocity approaching the traveling screens is about 1.3 ft/sec. The velocity approaching the screens for Unit 2 are 1.1 ft/sec at a unit flow of 735 cfs.

This information is provided in the permit application (see Attachment J - Design and Engineering Calculations of the CWIS). The elevation of the intake bells for Lake Hubbard is 388' msl.

(ii) Latitude and longitude in degrees, minutes and seconds for each of your cooling water structures;

This information is provided in the Texas Pollution Discharge Elimination System (TPDES) permit application in worksheet 11 question 2a.

(iii) A narrative description of the operation of each of your cooling water intake structures, including design intake flows, daily hours of operation number of days of the year in operation and seasonal changes, if applicable;

As discussed, the circulating water flow for Unit 1 pumps are each rated at 206 cfs (110.9 mgd) and the circulating water pumps for Unit 2 are each rated at 245 cfs (131.9 mgd) producing a total plant flow of 1,148 cfs (617.8 mgd).

Historically, LHSES operated at least one circulation water pump regardless of facility generation. This is reflected in Table 8-1 that show an average annual plant cooling water flow of 138.8 MGD even though capacity utilization was approximately 8.5% over the past five years. However, in mid-2018 pump operational practice was modified such that pumps are now operated only in conjunction with operation of the associated generating unit. The facility does not have any clear pattern of operation.

(iv) A flow distribution and water balance diagram that includes all sources of water to the facility, recirculating flows, and discharges;

An LHSES flow distribution diagram can be found as Attachment F of TPDES permit application.

(v) Engineering drawings of the cooling water intake structure

The CWIS engineering drawings for LHSES can be found in Attachment J (Design and Engineering Calculations of the CWIS) in the TPDES permit application.

4 SOURCE WATERBODY BIOLOGICAL INFORMATION

For facilities that are required to provide the source water biological characterization data at § 122.21(r)(4), the provision's introductory paragraph states:
"§122.21(r)(4) Source water baseline biological characterization data. This information is required to characterize the biological community in the vicinity of the cooling water intake structure and to characterize the operation of the cooling water intake structures. The Director may also use this information in subsequent permit renewal proceedings to determine if your Design and Construction Technology Plan as required in §125.86(b)(4) of this chapter should be revised. This supporting information must include existing data (if they are available). However, you may supplement the data using newly conducted field studies if you choose to do so."

This paragraph is followed by a list of twelve subsections. For LHSES, the source waterbody is Lake Hubbard Reservoir. Following is a list of each of the twelve subsections followed by either information relevant to that subsection or a summary of the information with more detail provided in Appendix B and or Appendix C.

(i) A list of data required in paragraphs (r)(4)(ii) through (r)(4)(vi) that were not available with an explanation of efforts to identify sources of that data.

All of the information was available and was provided in Appendix B. However, no site-specific entrainment data was collected in the vicinity of the intake.

(ii) A list of species (or relevant taxa) for all life stages and their relative abundance near the CWIS. While no site-specific data is available information is provided in Appendix B on species in the Lake Hubbard reservoir.

A list of relevant taxa is provided in Table 1 of Appendix B.

(iii) Identification of species and life stage that would be most susceptible to impingement and entrainment. Species evaluated must include the forage base as well as those important in terms of significance to commercial and recreational fisheries.

Section 3 of Appendix B provides a list of the species most susceptible to impingement and entrainment. Gizzard, threadfin shad "both forage species" and sunfish (larger larvae for entrainment and juveniles for impingement), are the three fishes most vulnerable to entrainment and impingement. Both shad species are vulnerable to entrainment since they are pelagic spawners and eggs and larvae remain in the water column where they can be drawn into the CWIS by the cooling water pumps. Juvenile shad and sunfish are vulnerable to impingement, however, due to their size and swimming speed, adults tend to be less vulnerable to impingement. Centrarchids, such as sunfish and largemouth bass (recreationally important

species) are nest builders such that eggs and early stage larvae are not vulnerable to entrainment since they remain on the bottom near the nest. However, later stage larvae can become more vulnerable as they leave their nests and juvenile sunfish are vulnerable to impingement.

(iv) Identification and evaluation of the primary period of reproduction, larval recruitment, and period of peak abundance of relevant taxa.

This information for the relevant species in Striker Reservoir is provided in Appendix B.

(v) Data representative of the seasonal and daily activities (e.g., feeding and water column migration) of biological organisms near the cooling water intake structure.

This information for the relevant species in Striker Reservoir is provided in Section 3 of Appendix B.

(vi) *Identification of all threatened and endangered species and/or designated critical habitat that are or may be present in the action area*[1].

There are no aquatic species federally listed as threatened or endangered or designated critical habitat that occur in Lake Hubbard Reservoir (U.S. Fish and Wildlife Service [USFWS], 2018). The only species federally listed as threatened or endangered for Dallas, Rockwall, Collin, and Kaufman Cherokee and Rusk counties are five species of birds (Table 4.1). For the five species of birds, none have a nexus with the LHSES CWIS. See Section 4 of Appendix B for more details on all of the species listed in Table 4.1. Therefore, the only potential impact to federally protected species would be in the event that a CCRS using cooling towers was required.

[1] The "action area" can be generally considered the area in the vicinity of impingement and entrainment at the CWIS.

Table 4.1 Federally Listed Species in the Vicinity of Lake Hubbard Reservoir Area

Common Name	Scientific Name	Federal Status*	Potential Habitat in Lake Area	Affected by Normal CWIS Operations
BIRDS				
Red Knot	*Calidris canutus rufa*	T	Yes	No
Piping Plover	*Charadrius melodus*	T	Yes	No
Golden-cheeked Warbler	*Setophaga chrysoparia*	E	No	No
Whooping Crane	*Grus americana*	E	Yes	No
Interior Least Tern	*Sternula antillarum*	E	Yes	No
Source: USFWS (2019).				
* T = Threatened; E = Endangered				

(vii) Documentation of any public participation or consultation with Federal or State agencies undertaken in development of the plan.

The Rule provides no information or explanation of what is meant by the "plan" relative to this requirement and as a result of the litigation, the EPA informed EPRI it is unable to elaborate on their intention regarding use of the term. However, there has been no public participation or consultation with Federal or State Agencies regarding source waterbody biological sampling.

(viii)—If the information requested in paragraph (r)(4)(i) of this section is supplemented with data collected using field studies, supporting documentation for the Source Water Baseline Biological Characterization must include a description of all methods and quality assurance procedures for sampling, and data analysis including a description of the study area; taxonomic identification of sampled and evaluated biological assemblages (including all life stages of fish and shellfish); and sampling and data analysis methods. The sampling and/or data analysis methods you use must be appropriate for a quantitative survey and based on consideration of methods used in other biological studies performed within the same source water body. The study area should include, at a minimum, the area of influence of the cooling water intake structure.

Luminant did not nor has no plans to collect new data by conducting field studies to supplement existing data and information for LHSES.

(ix) this part clarifies that the Source Water Baseline Characterization Data for owners/operators of existing facilities or new units at existing facilities is the information in paragraphs (r)(4)(i) through (xii) of this section.

This is simply a statement for clarification and does not require any specific information.

(x) Identification of protective measures and stabilization activities that have been implemented, and a description of how these measures and activities affected the baseline water condition near the intake.

No specific protective measures or stabilization activities have been implemented or required for LHSES.

(xi) A listing of fragile species, as defined at 40 CFR 125.92(m).

The EPA defines a fragile species of fish or shellfish at §125.92(m) of the Rule as either one of 14 listed species or as those that have an impingement survival rate of less than 30 percent to ensure that a facility's performance in reducing impingement mortality would only reflect effects of its improvements to the CWIS technology and not be biased by effects of data collection that are not caused by impingement. One listed "fragile" species, Gizzard Shad (*Dorosoma cepedianum*), is reported by TPWD to be present in Lake Hubbard Reservoir.

(xii) For owners/operators of existing facilities that have incidental take exemptions or authorization for its cooling water intake structure(s) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, to provide any information submitted to obtain those exemptions or authorizations to satisfy the permit application information requirement of paragraph 40 CFR 125.95(f) if included in the application.

Luminant has no incidental take exemptions or letters of authorization for LHSES's CWIS.

5 COOLING WATER SYSTEM

The Rule at § 122.21(r)(5) requires that Luminant provide the cooling water system data for LHSES. Each of the three subsections for this requirement is listed below and either the information is provided or the location where the information can be found in other LHSES documents provided to TCEQ.

(i) A narrative description of the operation of the cooling water system and its relationship to cooling water intake structures; the proportion of the design intake flow that is used in the system; the number of days of the year the cooling water system is in operation and seasonal changes in the operation of the system, if applicable; the proportion of design intake flow for contact cooling, non-contact cooling, and process uses; a distribution of water reuse to include cooling water reused as process water, process water reused for cooling, and the use of gray water for cooling; a description of reductions in total water withdrawals including cooling water intake flow reductions already achieved through minimized process water withdrawals; a description of any cooling water that is used in a manufacturing process either before or after it is used for cooling, including other recycled process water flows; the proportion of the source waterbody withdrawn (on a monthly basis);

Narrative Description of the Cooling Water System and Relationship to the CWIS – A description of the LHSES CWIS is provided in Chapter 3. LHSES's Units 1 and 2 both employ a once through cooling system such that after water is withdrawn from Lake Hubbard Reservoir through the CWIS and is conveyed through cooling water pipes to the Unit 1 and 2 condensers. After passing through the condensers the thermal discharge is conveyed and discharged back into the Lake Hubbard Reservoir where it is discharged at the north end of the facility at monitoring point 001.

Proportion of DIF Used in Cooling System – Over >98% of the design intake flow is used for condenser cooling

Number of Days of the Year Cooling System is in Operation and Seasonal Changes in Operation – As noted in Table 8-1 LHSES has a low capacity utilization over the past five years (i.e., approximately 8.5%). The generating units operate only when instructed to do so by ERCOT, which operates the electric grid and manages the deregulated market for 75 percent of the state. As discussed in Chapter 3 cooling water pumps as of the latter part of 2018 are now only in conjunction with operation of the associated generating unit.

Non-Contact Cooling and Process Uses and Use of Gray Water for Cooling – As a steam electric generating station, this provision is not applicable to LHSES.

Reductions in Total Water Withdrawals Already Achieved Through Minimized Process Water Withdrawals – As a steam electric generating station, this provision is not applicable to LHSES.

Description of Any Cooling Water That is Used in a Manufacturing Process – LHSES does not use any water for a manufacturing process.

The Proportion of the Source Waterbody Withdrawn on a Monthly Basis – Currently data is not available to make a reasonable estimate of current water withdrawals on a monthly basis. This is due to:

1. The change in cooling water pump operation to only operate in conjunction with operation of the associated generating unit
2. Overall low capacity utilization
3. All of the water in the reservoir is not used but only a region in an undetermined area surrounding the CWIS and that portion of the reservoir that includes the area of the circulation path between the discharge point back to the CWIS

(ii) Design and engineering calculations prepared by a qualified professional and supporting data to support the description required by paragraph (r)(5)(i) of this section – Yes, the calculations were made by a qualified professional engineer.

(iii) Description of existing impingement and entrainment technologies or operational measures and a summary of their performance, including but not limited to reductions in impingement mortality and entrainment due to intake location and reductions in total water withdrawals and usage - LHSES uses a CCRS discussed at § 125.94(c)(1) of the Rule. For this alternative the Rule states: *"A facility must operate a closed-cycle recirculating system as defined at §125.92(c). In addition, you must monitor the actual intake flows at a minimum frequency of daily. The monitoring must be representative of normal operating conditions, and must include measuring cooling water withdrawals, make-up water, and blow down volume. In lieu of daily intake flow monitoring, you may monitor your cycles of concentration at a minimum frequency of daily".* - TCEQ has agreed that the Lake Hubbard Reservoir qualifies as a CCRS and the Rule indicates that a CCRS is the best means of flow reduction and results in a proportional reduction in both impingement and entrainment. Additional Luminant has changed cooling water flow practices at LHSES such that the pumps are operated only when the facility is generating electricity. This practice has resulted in an AIF <125 mgd.

6 CHOSEN METHOD OF COMPLIANCE FOR IMPINGEMENT

The Rule at § 122.21(r)(6) requires Luminant to discuss the chosen method of compliance with the impingement mortality standard for LHSES. Facilities must either select one of the seven alternatives at § 125.95(c)(1) through (7) unless the facility qualifies for an exemption or a less stringent standard. The owner/operator must identify the chosen compliance method for the entire facility; alternatively, the applicant must identify the chosen compliance method for each cooling water intake structure at its facility. For impingement mortality BTA for the LHSES Luminant chooses use of a CCRS as defined at § 125.94(c)(1) of the Rule and TCEQ's September 2, 2015 letter to Luminant (Appendix A) approved use of the CCRS as impingement BTA.

7 ENTRAINMENT PERFORMANCE STUDY INFORMATION

The Rule at §122.21(r)(7) requires Luminant to discuss entrainment performance studies for LHSES. Specifically, the Rule requires "*The owner or operator of an existing facility must submit any previously conducted studies or studies obtained from other facilities addressing technology efficacy, through-facility entrainment survival, and other entrainment studies. Any such submittals must include a description of each study, together with underlying data, and a summary of any conclusions or results. Any studies conducted at other locations must include an explanation as to why the data from other locations are relevant and representative of conditions at your facility. In the case of studies more than 10 years old, the applicant must explain why the data are still relevant and representative of conditions at the facility and explain how the data should be interpreted using the definition of entrainment at 40 CFR 125.92(h).*"

Luminant has never conducted entrainment performance studies at LHSES. Luminant did participate in an EPRI § 316(b) supplemental project that included conducting a literature survey of all impingement and entrainment performance studies that could be located. The final report for the literature survey is titled "*Narrative Descriptions of Impingement and Entrainment Survival Studies*" (EPRI 2014). This study identified 16 entrainment survival studies, some of which were through plant survival studies and some of which were survival after collection on fine-mesh traveling water screens. However, 13 of the studies were conducted at facilities located on oceans and estuaries where species are not representative of LHSES's source waterbody; two of the studies were conducted on the Great Lakes and the third was conducted on the mainstem Missouri River and none are considered representative for a freshwater water reservoir and the species subject to entrainment at LHSES.

8 SYSTEM OPERATION INFORMATION

The Rule at § 122.21(r)(8) requires Luminant to discuss the operational status of LHSES. Specifically, *"the owner or operator of an existing facility must submit a description of the operational status of each generating, production, or process unit that uses cooling water.*

Below each of the five subsections for this information is stated, followed either by the information or where that information can be found in other Luminant documents provided to TCEQ.

(i) For power production or steam generation, descriptions of individual unit operating status including age of each unit, capacity utilization rate (or equivalent) for the previous 5 years, including any extended or unusual outages that significantly affect current data for flow, impingement, entrainment, or other factors, including identification of any operating unit with a capacity utilization rate of less than 8 percent averaged over a 24-month block contiguous period, and any major upgrades completed within the last 15 years, including but not limited to boiler replacement, condenser replacement, turbine replacement, or changes to fuel type;

LHSES has two operating units and Unit 1 went into operation in 1970 and Unit 2 went into operation in 1973. Capacity utilization for the last five years is shown in Table 2-1. There were no unusual or significant outages. Capacity utilization was <10% for the last four years. No major upgrades or changes in fuel type occurred during the prior fifteen years. Also provided are the average annual actual intake flows for the past five years (i.e. 2014 – 2018) and the five-year average is 138.8 mgd. However, for the purpose of determining if the facility must provide the impingement information at § 122.21(r)(9)-(13) the definition of AIF at § 125.92(a) states that currently (i.e., prior to October 14, 2019) AIF is based on the most current three years of flow data. The AIF for the purpose of this permit application is 119.9 mgd or <125 mgd and therefore LHSES is currently not subject to providing the entrainment information at § 122.21(r)(9)-(13).

Table 8-1 Flow (3 years) and capacity utilization data (5 years) for LHSES

Flow/Capacity Utilization	2014	2015	2016	2017	2018	5 Year Average
Average Flow (MGD)	201.1	133.3	122.3	96.6	140.7	138.8
Capacity Utilization[a]	11.33%	7.72%	8.28%	5.24%	9.94%	8.50%

a. Note that the capacity factors are corrected from the prior version sent to TCEQ on 9/20/2018.

(ii) Descriptions of completed, approved, or scheduled uprates and Nuclear Regulatory Commission relicensing status of each unit at nuclear facilities – LHSES has only fossil units and this provision is not applicable to the facility.

(iii) *For process units at your facility that use cooling water other than for power production or steam generation, if you intend to use reductions in flow or changes in operations to meet the requirements of 40 CFR 125.94(c), descriptions of individual production processes and product lines, operating status including age of each line, seasonal operation, including any extended or unusual outages that significantly affect current data for flow, impingement, entrainment, or other factors, any major upgrades completed within the last 15 years, and plans or schedules for decommissioning or replacement of process units or production processes and product lines* – LHSES has no processing units and this subsection is not applicable to the facility.

(iv) *For all manufacturing facilities, descriptions of current and future production schedules* – LHSES is not a manufacturing facility and this subsection is not applicable to the facility.

(v) *Descriptions of plans or schedules for any new units planned within the next 5 years* – Luminant has no plans to construct any new units at LHSES in the next five years.

9 122.21(R) INFORMATION WAIVIER REQUEST

The Rule at § 125.95(a)(3) includes a provision that states: *"The Director may waive some or all of the information requirements of 40 CFR 122.21(r) if the intake is located in a manmade lake or reservoir and the fisheries are stocked and managed by a State or Federal natural resources agency or the equivalent. If the manmade lake or reservoir contains Federally-listed threatened and endangered species, or is designated critical habitat, such a waiver shall not be granted."*

The purpose of this chapter is to document that Luminant's LHSES qualifies for the § 122.21(r) information waiver and to formally request that the entrainment information at § 122.21(r)(9) – (13) be waived. The provision at § 125.95(a)(3) has three key components for facilities to qualify for the wavier and each is discussed separately.

9.1 LHSES Withdraws Condenser Cooling Water from a Manmade Lake or Reservoir

Cooling makeup water for LHSES's CCRS is withdrawn from the Lake Hubbard Reservoir. A description of the history of dam construction was extracted from the Texas Water Development Board (http://www.twdb.texas.gov/surfacewater/rivers/reservoirs/ray_hubbard/index.asp). The text from the Water Board website is provided in Chapter 2 of this document and documents the history of construction of the dam that created the reservoir.

The purpose of the dam is to provide water storage for municipal and industrial water supply, flood control and recreation..

9.2 Lake Hubbard Reservoir Has a Stocked and Managed Fishery

The Lake Hubbard Reservoir is stocked and managed by the Texas Parks and Wildlife Department (TPWD). A description of the fishery and management plan for the reservoir can be found on the TPWD website (https://tpwd.texas.gov/fishboat/fish/action/stock_bywater.php?WB_code=0600) and is provided below:

Management History Plans:
Important sport fish include Largemouth Bass, White Bass, White Crappie, and catfishes. Sport fishes are regulated by statewide harvest regulations. Threadfin Shad were introduced in 1984. Channel Catfish were introduced in 1970. Palmetto Bass were stocked in 1979 and 1984. Florida Largemouth Bass were introduced in 1979, stocked during the early 1990's, stocked in 2003, and they were last stocked in 2011 and 2012.

Fish Community

- Prey species: Electrofishing catch of prey species was low and consisted primarily of Gizzard Shad, Bluegill, and Longear Sunfish. Other fish species were also available as prey. Sunfish species were of sizes that were available to most sport fish. Gizzard Shad < 7 inches were present in high relative abundance and were available to most sport fish.

- Catfishes: Channel Catfish, Blue Catfish, and Flathead Catfish were present in the reservoir. Blue Catfish were the most abundant catfish species observed during gill net surveys. Most of the Blue Catfish were of harvestable size.
- White Bass: In 2016, White Bass relative abundance was low, and all fish sampled were harvestable size.
- Largemouth Bass: In 2015, Largemouth Bass relative abundance and number of large fish were low. Legal-sized fish were not relatively abundant in the survey
- White Crappie: In 2015, White Crappie relative abundance was low. Mean relative weight for most inch classes ranged from 90-110. Legal-sized White Crappie were not relatively abundant in the survey.

Management Strategies:

- Largemouth Bass and prey items will be surveyed in fall 2017.
- Trap netting, gill netting, and electrofishing surveys will be conducted in 2019-2020 for relative abundance, size structure, and mean relative weight data.
- Access and habitat surveys will be conducted in summer 2019.
- Inform the public of the threat and impact of invasive species.

The stocking history can be found on the TPWD website (https://tpwd.texas.gov/fishboat/fish/action/stock_bywater.php?WB_code=0600) and the history is provided in Table 9-1. As shown in Table 9-1, stocking took place most recently in 2018 with the stocking of 171,876 Palmetto Bass and 159,900 Sunshine Bass.

Table 9-1 – Stocking History for Lake Hubbard

History of Lake Hubbard Fish Stocking			
Species	Year	Number Stocked	Size
Bass, Palmetto	2018	173,876	Fingerling
Bass, Sunshine	2018	159,900	Fingerling
Bass, Palmetto	2017	227,550	Fingerling
Bass, Sunshine	2017	26,686	Fingerling
Bass, Palmetto	2016	103,070	Fingerling
Bass, Florida Largemouth	2015	133,112	Fingerling
Bass, Palmetto	2015	1,313,287	Fry
Bass, Sunshine	2015	45,000	Fingerling
Bass, Florida Largemouth	2014	433,353	Fingerling
Bass, Palmetto	2014	88,552	Fingerling
Bass, Sunshine	2014	93,011	Fingerling
Bass, Florida Largemouth	2013	502,264	Fingerling
Bass, Palmetto	2013	2,074,929	Fry
Bass, Sunshine	2013	45,000	Fingerling
Bass, Florida Largemouth	2012	573,599	Fingerling
Bass, Florida Largemouth	2011	511,897	Fingerling

Bass, Palmetto	2011	105,118	Fingerling
Bass, Florida Largemouth	2010	520,551	Fingerling
Bass, Palmetto	2009	107,290	Fingerling
Bass, Palmetto	2008	114,846	Fingerling
Bass, Florida Largemouth	2007	543,441	Fingerling
Bass, Palmetto	2007	152,637	Fingerling
Bass, Florida Largemouth	2006	542,236	Fingerling
Bass, Palmetto	2005	216,814	Fingerling
Bass, Palmetto	2005	1,501,902	Fry
Bass, Palmetto	2004	100,438	Fingerling
Bass, Florida Largemouth	2003	5,000	Fingerling
Bass, Palmetto	2003	162,993	Fingerling
Bass, Palmetto	2002	172,336	Fingerling
Bass, Florida Largemouth	2001	501,365	Fingerling
Bass, Palmetto	1999	56,945	Fingerling
Bass, Florida Largemouth	1996	549,328	Fingerling
Bass, Palmetto	1996	250,702	Fingerling
Bass, Striped	1996	11,598	Fingerling
Bass, Palmetto	1995	346,142	Fingerling
Bass, Palmetto	1994	341,661	Fingerling
Bass, Palmetto	1993	171,853	Fingerling
Bass, Palmetto	1993	940,000	Fry
Catfish, Blue	1993	399,958	Fingerling
Bass, Palmetto	1992	325,185	Fingerling
Bass, Florida Largemouth	1991	568,891	Fingerling
Bass, Palmetto	1991	235,994	Fingerling
Catfish, Blue	1990	109,175	Fingerling
Bass, Palmetto	1989	460,946	Fingerling
Bass, Florida Largemouth	1988	64,872	Fingerling
Bass, Mixed Largemouth	1988	502,897	
Bass, Palmetto	1988	455,847	Fingerling
Bass, Palmetto	1987	455,017	Fingerling
Bass, Striped	1986	225,200	Fingerling
Bass, Palmetto	1985	271,952	Fingerling
Bass, Striped	1984	338,680	Fingerling
Bass, Striped	1983	115,868	
Bass, Palmetto	1982	232,701	
Bass, Striped	1981	113,482	
Walleye	1981	19,237	

Bass, Palmetto	1980	101,800	
Bass, Palmetto	1979	114,000	
Bass, Striped	1979	111,225	
Bass, Palmetto	1976	149,616	
Walleye	1976	230,000	
Catfish, Channel	1971	96,830	
Bass, Largemouth	1970	2,204,000	
Bass, Largemouth	1968	1,471,600	

9.3 Lake Hubbard Does Not Have Federally Protected Threatened and Endangered Species or Designated Critical Habitat

As discussed in Chapter 4, there is no risk to federally threatened or endangered species nor their designated critical habitat due to LHSES CWIS operations. While there are five federally listed bird species in the area none are affected by LHSES's CWIS.

9.4 Request For Wavier Of The § 122.21(r)(9)-(13) Entrainment Information

LHSES AIF over the past three years has averaged just under 119.9 MGD and thus is less than the 125 mgd AIF that requires submittal of the § 122.21(r)(9)-(13) information. LHSES should qualify for the waiver of the § 122.21(r) information at § 125.95(a)(3) of the Rule and based on the information provided in Subsections 9.1, 9.2 and 9.3 in this chapter formally requests a waiver of that information.

10 INFORMATION TO INFORM THE LHSES SITE-SPECIFIC ENTRAINMENT BTA DETERMINATION

10-1 Director Requirements at §125.98(f)

While Luminant qualifies for a waiver from the entrainment information at § 122.21(r)(9)-(13), TCEQ is still required to make an entrainment BTA determination for LHSES as discussed at § 125.98(f) of the Rule which states:

"(f) Site-specific entrainment requirements. The Director must establish site-specific requirements for entrainment after reviewing the information submitted under 40 CFR 122.21(r) and § 125.95. These entrainment requirements must reflect the Director's determination of the maximum reduction in entrainment warranted after consideration of factors relevant for determining the best technology available for minimizing adverse environmental impact at each facility. These entrainment requirements may also reflect any control measures to reduce entrainment of Federally-listed threatened and endangered species and designated critical habitat (e.g. prey base). The Director may reject an otherwise available technology as a basis for entrainment requirements if the Director determines there are unacceptable adverse impacts including impingement, entrainment, or other adverse effects to Federally-listed threatened or endangered species or designated critical habitat. Prior to any permit reissuance after July 14, 2018, the Director must review the performance of the facility's installed entrainment technology to determine whether it continues to meet the requirements of § 125.94(d).

(1) The Director must provide a written explanation of the proposed entrainment determination in the fact sheet or statement of basis for the proposed permit under 40 CFR 124.7 or 124.8. The written explanation must describe why the Director has rejected any entrainment control technologies or measures that perform better than the selected technologies or measures, and must reflect consideration of all reasonable attempts to mitigate any adverse impacts of otherwise available better performing entrainment technologies.

(2) The proposed determination in the fact sheet or statement of basis must be based on consideration of any additional information required by the Director at § 125.98(i) and the following factors listed below. The weight given to each factor is within the Director's discretion based upon the circumstances of each facility.

(i) Numbers and types of organisms entrained, including, specifically, the numbers and species (or lowest taxonomic classification possible) of Federally-listed, threatened and endangered species, and designated critical habitat (e.g., prey base);

(ii) Impact of changes in particulate emissions or other pollutants associated with entrainment technologies;

(iii) Land availability inasmuch as it relates to the feasibility of entrainment technology;

(iv) Remaining useful plant life; and

(v) Quantified and qualitative social benefits and costs of available entrainment technologies when such information on both benefits and costs is of sufficient rigor to make a decision.

(3) The proposed determination in the fact sheet or statement of basis may be based on consideration of the following factors to the extent the applicant submitted information under 40 CFR 122.21(r) on these factors:

(i) Entrainment impacts on the waterbody;

(ii) Thermal discharge impacts;

(iii) Credit for reductions in flow associated with the retirement of units occurring within the ten years preceding October 14, 2014;

(iv) Impacts on the reliability of energy delivery within the immediate area;

(v) Impacts on water consumption; and

(vi) Availability of process water, gray water, waste water, reclaimed water, or other waters of appropriate quantity and quality for reuse as cooling water.

(4) If all technologies considered have social costs not justified by the social benefits, or have unacceptable adverse impacts that cannot be mitigated, the Director may determine that no additional control requirements are necessary beyond what the facility is already doing. The Director may reject an otherwise available technology as a BTA standard for entrainment if the social costs are not justified by the social benefits."

While detailed entrainment studies should not be required for LHSES, based on the information provide in Chapter 9 (i.e., the facility is located on a man-made reservoir with a stocked and managed fishery), TCEQ is still required to make an entrainment BTA determination. Therefore, Luminant is providing information in this Chapter to aid TCEQ in making the LHSES entrainment BTA determination.

10.2 Factors That Must Be Considered

Each of the five factors that **must be considered** in making the entrainment BTA determination are discussed below.

10.2.1 Numbers and Types of Organisms Entrained

The Rule states for this factor "*(i) Numbers and types of organisms entrained, including, specifically, the numbers and species (or lowest taxonomic classification possible) of Federally-listed, threatened and endangered species, and designated critical habitat (e.g., prey base);*"

The numbers and types of organisms expected to be entrained is discussed in Chapter 3 of Appendix B. Also attached is the TPWS 2015 Lake Hubbard fisheries monitoring report (most recent). The summary information is provided below.

Important sport fish include Largemouth Bass, White Bass, White Crappie, and catfishes. Sport fishes are regulated by statewide harvest regulations. Threadfin Shad were introduced in 1984. Channel Catfish were introduced in 1970. Palmetto Bass were stocked in 1979 and 1984. Florida Largemouth Bass were introduced in 1979, stocked during the early 1990's, stocked in 2003, and they were last stocked in 2011 and 2012.

Prey species: Electrofishing catch of prey species was low and consisted primarily of Gizzard Shad, Bluegill, and Longear Sunfish. Other fish species were also available as prey. Sunfish species were of sizes that were available to most sport fish. Gizzard Shad < 7 inches were present in high relative abundance and were available to most sport fish.

Catfishes: Channel Catfish, Blue Catfish, and Flathead Catfish were present in the reservoir. Blue Catfish were the most abundant catfish species observed during gill net surveys. Most of the Blue Catfish were of harvestable size.

White Bass: In 2016, White Bass relative abundance was low, and all fish sampled were harvestable size.

Largemouth Bass: In 2015, Largemouth Bass relative abundance and number of large fish were low. Legal-sized fish were not relatively abundant in the survey.

White Crappie: In 2015, White Crappie relative abundance was low. Mean relative weight for most inch classes ranged from 90-110. Legal-sized White Crappie were not relatively abundant in the survey.

Importantly Lake Hubbard Reservoir does not contain any federally protected federal threatened or endangered species and the reservoir is not designated critical habitat for such species.

10.2.2 Impact of Particulate Emissions or Other Pollutants

The Rule states for this factor "*(ii) Impact of changes in particulate emissions or other pollutants associated with entrainment technologies;*"

A CCRS with a mechanical draft cooling tower is the only technology that would generate particulate emissions. However, due to the low capacity utilization over the past five years (i.e., <10%) and the estimated cost of a CCRS retrofit (i.e., $209.8 million to over $660 million) LHSES would most likely be retired if a retrofit was required.

10.2.3 Land Availability

The Rule states for this factor "*(iii) Land availability inasmuch as it relates to the feasibility of entrainment technology;*

The Rule states for this factor "*(iii) Land availability inasmuch as it relates to the feasibility of entrainment technology;* - The circulating water flow for the two units at LHSES is 430,000 gpm. Assuming a tower with 60' x 60' cells (common choice for towers of the size required for LHSES) and a water loading of 6 gpm/ft^2 (typical, intermediate choice), 20 cells are required. In a back-to-back configuration this is a tower with a footprint of about 610' x 130' (assumes 5' basin extension all around). Based on these assumptions as shown in Figure 10-1 there is adequate space for a mechanical draft CCRS at LHSES.

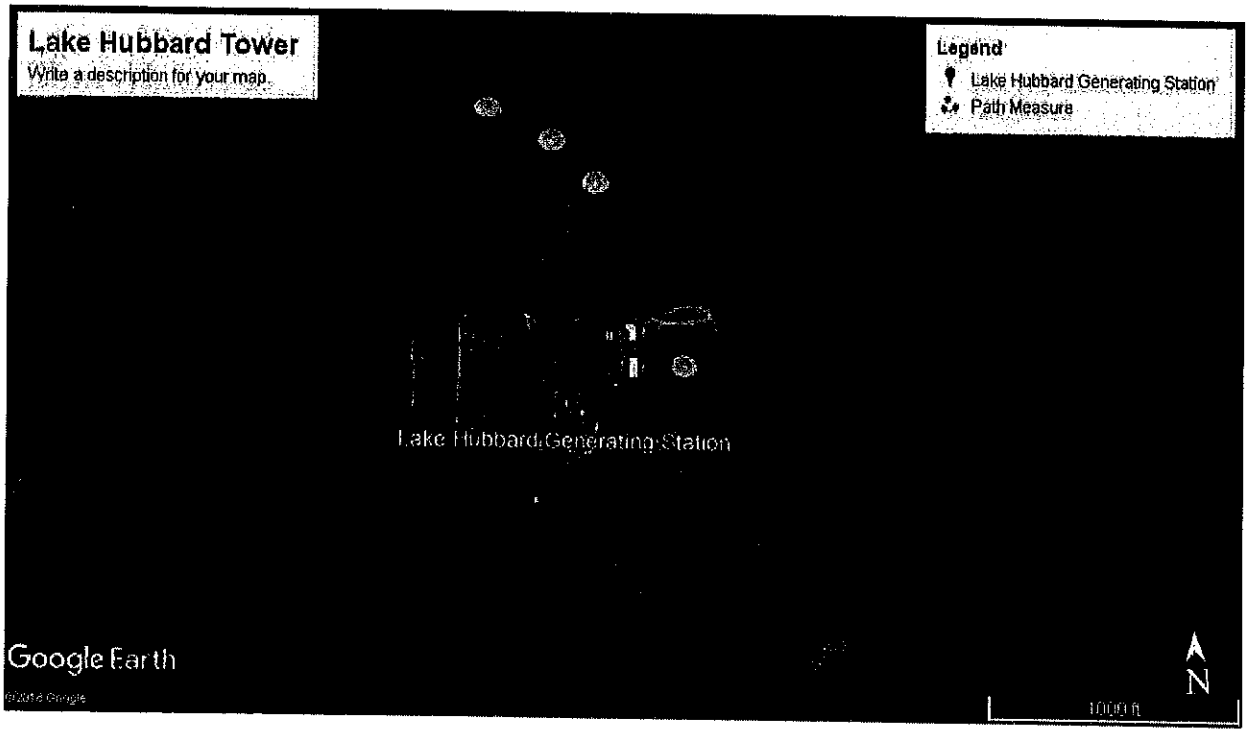

Figure 10-1 Two possible locations (shown in red rectangle just north and south of the generating station) of a closed-cycle cooling mechanical draft cooling tower at LHSES

10.2.4 Remaining Useful Plant Life

The Rule states for this factor "*(iv) Remaining useful plant life;* - No retirement data has been announced for LHSES.

10.2.5 Quantified Benefits and Costs

The Rule states for this factor *"(v) Quantified and qualitative social benefits and costs of available entrainment technologies when such information on both benefits and costs is of sufficient rigor to make a decision.* In terms of the costs of entrainment reduction technologies, an evaluation of these technologies required by the Rule at § 122.21(r)(10)(i) is provided below in subsection 9.2.5.1.

10.2.5.1 Entrainment Reduction Technology Costs

For facilities required to submit the Comprehensive Technical Feasibility and Cost Evaluation Study (i.e., § 122.21(r)(10) information), the Rule requires that three technologies be evaluated that include:

1. Flow reduction using a closed-cycle recirculating system (i.e., CCRS)
2. Fine-mesh screens that include both fine-mesh traveling water screens and narrow-slot wedgewire screens
3. Alternative water sources

Each of these alternatives is discussed below.

10.2.5.1.1 Use of a CCRS

LHSES already employs a CCRS as documented in Appendix A. The Rule states "*EPA assumes that entrainment and impingement (and associated mortality) at a site are proportional to source water intake volume. Thus, if a facility reduces its intake flow, it similarly reduces the amount of organisms subject to impingement and entrainment.*" (page 48331, column 2, 1. Flow Reduction). The EPA further states:

"*The technology* (referring to a CCRS) *is also highly effective, generally achieving greater than 95 percent reductions in IM and E (mechanical draft (wet) cooling towers achieve flow reductions of 97.5 percent for freshwater and 94.9 percent for saltwater sources, or by operating the towers at a minimum of 3.0 and 1.5 cycles-of concentration, respectively). These reductions in flow and the concurrent reductions in impingement and entrainment impacts are among the highest reductions in adverse environmental impact possible at an intake structure.*"

Thus, Luminant's use of Lake Hubbard as a CCRS, means LHSES is currently reducing entrainment by 95% or more. TCEQ, however, could require use of a cooling tower as defined at § 129.92(c)(1). EPRI conducted a study to inform the § 316(b) Rulemaking on the cost and implications of designating a CCRS as BTA for entrainment. In that study, EPRI used a method referred to as the "degree of difficulty" approach to estimate the cost of retrofitting 125 once-through cooled facilities with mechanical draft cooling towers. A detailed description of the methodology and results are provided in EPRI Technical Report No. 1022491 (EPRI 2011). The EPA reviewed EPRI's method and decided to use this method in their Technical Development Document (TDD) for the Rule to estimate the cost of CCRS retrofits (USEPA 2014b). That method rates CCRS retrofits from easy to more difficult based on consideration of eleven site-specific factors and the costs for each of the four degree of difficulty rating is provided in Figure 10-2. While a site-specific evaluation was not conducted for LHSES, based on LHSES's design intake cooling water flow (488,000 gpm) a CCRS mechanical draft retrofit cost depending on the degree of difficulty would be:

1. Easy -$102.4 million
2. Average - $134.2 million
3. Difficult - $197.6 million
4. Very Difficult - $322.5 million

Note that the estimates are made after scaling up the difficulty cost factors shown in Figure 10-2 from 2010 to 2019 dollars using https://www.usinflationcalculator.com/.

In terms of social costs, given that LHSES's capacity utilization rate over the past five years is 8.5% and it would not likely be economical to perform a retrofit even if at the easy retrofit cost. If required, it would, therefore, most likely be retired and the social costs would include:

- Loss of jobs at the facility
- Loss of taxes to area that support schools and public projects
- Loss of income for businesses that provide goods and services to the facility

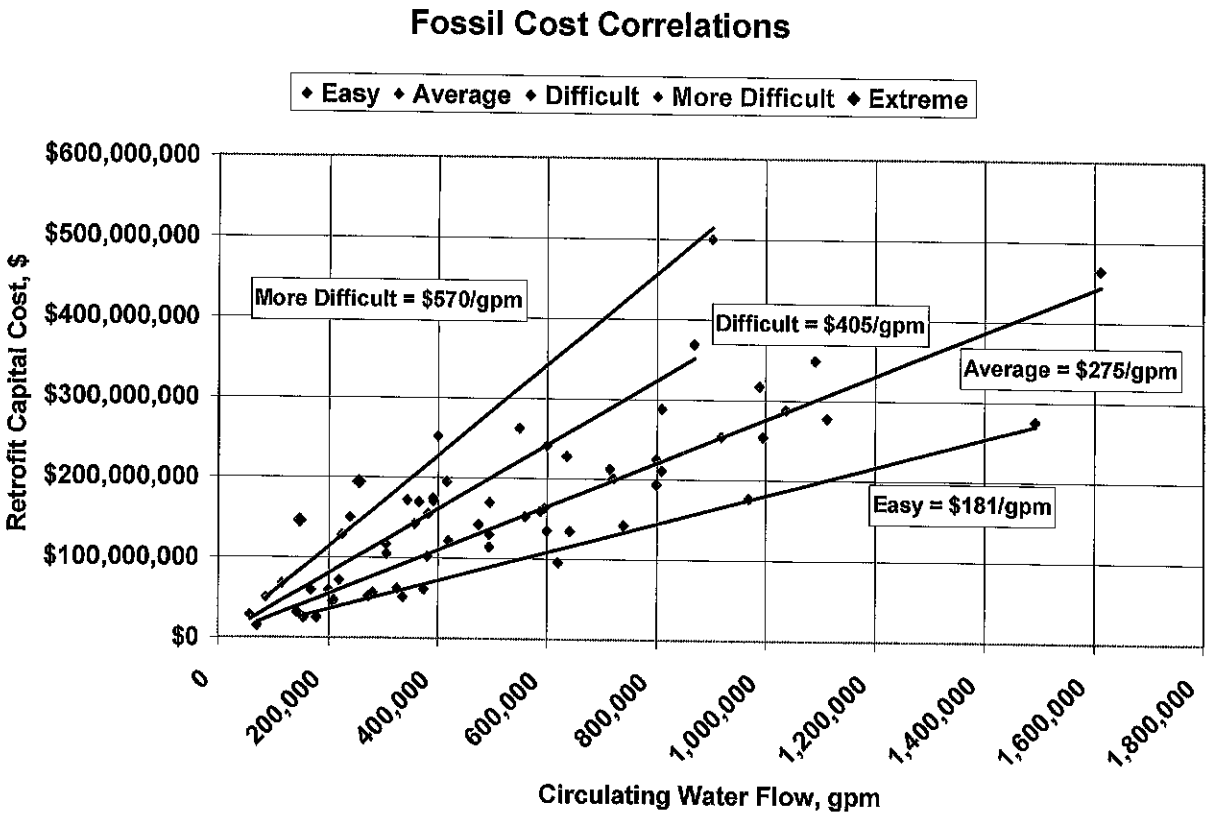

Figure 10-2. Degree of difficulty CCRS retrofit costs based on EPRI cost of CCRS retrofit study (EPRI 2010).

10.2.5.1.2 Use of Fine-mesh Screens

This subsection provides a summary of the information required at § 122.21(r)(10)(i) for installation of fine-mesh screens at LHSES to reduce entrainment. A detailed report providing the full set of information is provided as Appendix D. This summary section begins with an overall discussion of the different types of screens. The discussion is followed by a description of the methodology used to estimate the specific screen types evaluated for LHSES and concludes by discussing the technical feasibility and compliance cost for both fine-mesh modified traveling screens and narrow-slot wedgewire screens.

10.2.5.1.2.1 Fine-mesh Modified Traveling Screens

Modified traveling water screens are a fish collection and transfer technology and is defined at § 125.92(s) of the Rule. The technology involves modifying traveling water screens in a manner designed to collect fish off the screens to maximize survival, then return them to a location in the source waterbody outside the hydraulic zone of influence of the CWIS and the thermal discharge to reduce the chance of re-impingement or exposure to elevated water temperatures. Key features of this technology that are specified in the Rule's definition include:

- fish collection buckets at the bottom of the screens designed to minimize turbulence;
- a guard rail or barrier designed to prevent fish from jumping out of the buckets;

- use of a smooth fabric or material for the screens to minimize abrasion and/or descaling;
- continuous or near continuous screen rotation;
- use of a low pressure wash or gentle vacuum to remove fish from the screens; and
- use of a fish return with adequate flow to transport fish to the source waterbody, predation prevention and avoiding a high drop from the return to the source waterbody.

The technology is generally feasible for facilities usually can be installed in existing screen wells, as a replacement for an existing conventional traveling water screens. There have been a number of new screens developed for use in the U.S. over the last decade, and screen types, in addition to modified ("Ristroph") screens, include screens manufactured by Aqseptance Group (rotary), Hydrolox (molded polymer) and Beaudrey (vacuum). Most of the new screens have advantages in terms of preventing by-pass of debris and organisms and improving overall debris management.

While fine-mesh traveling screens tend to be the lowest cost entrainment reduction technology, biological performance (i.e., entrainment survival) for early life stages (e.g., larvae <12 mm) is generally poor (<0 to 15%) as the larvae have not yet developed scales and musculature needed to survive the collection and handling process associated with this technology (EPRI 2010). After development of scales and musculature, biological performance improves (depending on species and life stage), however, for fragile species, such as clupeids (including gizzard and threadfin shad), that are likely to dominate entrainment at LHSES, survival continues to be poor and is often <30% (EPRI 2006).

For LHSES's CWIS the estimated capital and O&M cost for modified fine-mesh traveling screens are provided in Table 5-1 below and the estimated net present value and annualized costs discounted at 7% and 3% are provided in Table 5-2 below. A detailed discussion of these screens is provided in Section 3 of Appendix D.

Table 10-1. Estimated cost of modified fine-mesh traveling water screens for LHSES.

Capital Cost (millions)	Permitting and Pre-construction Study Cost	Annual O&M Cost
$10.9	$394,000	$497,000

Table 10-2 Estimated net present value and equivalent annual costs at both 7% and 3% discount rates for fine-mesh modified traveling screens at LHSES.

Technology	IPS Fine-mesh Modified Traveling Screens with a New Fish Return (millions)
Net Present Value (2016 $) (7% Discount rate)	$13.50 M
Net Present Value (2016 $) (3% Discount rate)	$16.81 M
Equivalent Annual Cost (2016 $) (7% Discount rate)	$1.09 M
Equivalent Annual Cost (2016 $) (3% Discount rate)	$1.35

10.2.5.1.2.2 Narrow-slot Wedgewire Screens

Narrow-slot (i.e., <2mm) cylindrical wedgewire screens are a passive exclusion technology and generally designed to have a low maximum through-screen velocity (i.e., <0.5 ft/sec). The low through-screen velocity combined with ambient current in the source waterbody tend to carry fish eggs and larvae past the screen modules and, thereby, exclude them from entering the cooling water system. Other than use of a CCRS, these devices tend to be the best performing fish protection technology for both entrainment and impingement. Depending on the species and their life stages present in the source waterbody, performance can potentially exceed that of a CCRS. Cylindrical wedgewire screens are constructed by wrapping a wedge-shaped wire around a support frame resulting in a smooth surface with no mesh. Instead, there is a continuous slot from one end of the cylinder to the other. A discussion of cylindrical wedgewire screens is provided in the Rule Preamble (see page 48334, column 2) and EPRI Technical Report 3002000231 (EPRI 2013). In order for the screens not to exceed a through-screen velocity of 0.5 ft/sec, for a smaller slot size, either more or larger screen modules are required to increase the screen surface area to not exceed the 0.5 ft/sec criterion.

There have been improvements in the design of cylindrical wedgewire screens, most notably in methods to control debris accumulation and biofouling. Depending on the nature of debris and biofouling in the source waterbody, material can be removed via a burst of compressed air to blow material off the screens or use of a mechanical brush cleaning system, but in some cases manual cleaning by divers may be required. The number and size of narrow-slot wedgewire screen modules is a function of the facility cooling water flow volume, depth of the source

waterbody, navigation issues and required slot size. Issues that can affect use of the technology include debris loading, biofouling, frazil ice in the winter, source waterbody depth and potential source waterbody navigation issues and loss of surface water area to public access.

The LHSES evaluation determined that it would be feasible to deploy this technology in the Lake Hubbard Reservoir in the front of the LHSES CWIS. However, permits and approvals would be required, as well as some additional cost for permitting and approvals, since Luminant does not own the reservoir and there would be loss of area in the reservoir for public use. Two screen slot sizes were evaluated and included 0.5 mm and 2 mm. The 0.5 mm is considered the smallest slot size technically feasible and would the best biological performance. However, it would also have the highest cost since more screen modules are required to not exceed the 0.5 fps through screen velocity criterion. The basis for 2.0 mm is that the EPA in the Rule stated that this is the largest mesh (slot) size they considered to be effective for entrainment reduction. Potential deployment at LHSES for 0.5 mm and 2.0 mm slot widths are shown in Appendix D in Figures 4-2 and 4-3, respectively. As shown in Figures 4-2 and 4-3, for both slot sizes a sheet pile bulk head isolation wall would be constructed across the existing intake and four seven ft diameter header pipes would be extended out from the sheet pile wall and the screen modules would be mounted on the header pipes. For deployment of 0.5 mm slot screens it would require 48 – 84-inch diameter cylindrical wedgewire screen modules to supply condenser cooling water and for the 2.0 mm slot size 20 – 72 in. diameter cylindrical wedgewire screen modules would be needed (see Appendix D Table 4-1). Based on the proposed design, the analysis estimated the capital and O&M costs to accommodate mesh sizes of 0.5 mm and 2.0 mm slot sizes for LHSES. The results of the analysis are provided in Table 10-3 below. Capital costs to accommodate the total LHSES flow range from $33.01 million for 0.5 mm screens to $16.42 million for 2 mm screens. Additional costs would be incurred to conduct studies to verify biofouling and debris control management, since there is very little sweeping flow in the Lake Hubbard Reservoir and the impact of the screens on cooling water pump performance. Table 10-4 below provides the estimated net present value and annualized cost estimates at a 7% and 3% discount rate for both slot sizes as required by the Rule.

A detailed discussion of the evaluation methods and assumptions for the evaluation can be found in Appendix D.

Table 10-3 Estimated cost for narrow-slot wedgewire screens at LHSES

Slot-size	Capital Cost (millions)	Permitting and Pre-construction Study Cost	Annual O&M Cost
0.5 mm	$33.01	$677,000	$768,000
2.0 mm	$16.42	$488,000	$309,000

Table 10-4 Estimated present value and annualized costs for 0.5 mm and 2.0 mm narrow-slot wedgewire screens for LHSES at discount rates of 7% and 3%

Technology	Narrow-slot Wedgewire Screens with 0.5 mm Slots (millions)	Narrow-slot Wedgewire Screens with 2.0 mm Slots (millions)
Net Present Value (2017 $) (7% Discount rate)	$45.0	$18.0
Net Present Value (2017 $) (3% Discount rate)	$37.5	$21.3
Equivalent Annual Cost (2017 $) (7% Discount rate)	$3.0	$1.5
Equivalent Annual Cost (2017 $) (3% Discount rate)	$3.6	$1.7

In summary, at capital costs in excess of $10.9 million dollars for modified fine-mesh screens and almost a cost of $16.4 to 33.0 million for 2.0 mm and 0.5 narrow-slot wedgewire screens sizes respectively, installation of these technologies would not make economic sense given LHSES's low capacity utilization and would place the facility at a severe economic disadvantage and threaten its future viability.

10.2.5.1.3 Use of Alternative Cooling Water Sources and Water Reuse

The Rule at § 122.21(r)(10)(i) requires evaluation of *"water reuse or alternate sources of cooling water"* and in subsection (C) of that provision *"A discussion of available sources of process water, grey water, waste water, reclaimed water, or other waters of appropriate quantity and quality for use as some or all of the cooling water needs of the facility"*. However, the EPA in the Rule's Technical Development Document (USEPA 2014) Section 6.1.4 titled Water Reuse states *"For power plants, water reuse (outside of closed-cycle cooling) is typically not an available option, as there is very little water that is used for purposes other than non-contact cooling; the "credit" would be extremely small. EPA has seen examples where cooling water is reused in air pollution control processes."* LHSES is no exception to this finding, and water reuse, other than through use of a CCRS as discussed in Section 9.2.5.1.1 of this document is not considered technically feasible. The Rule's Technical Development Document provides a similar conclusion for use of alternative cooling water sources in Section 6.1.5 titled Alternative Cooling Sources and this section states:

"Unfortunately, many facilities have cooling needs that substantially outpace the volume of water available to them from alternate sources, especially for once-through cooling systems. In the California's Coastal Power Plants: Alternate Cooling System Analysis, OPC analyzed alternate sources as cooling tower makeup water but concluded that even for power plants located in densely populated areas of southern California (where infrastructure to facilitate alternate sources such as grey water may already exist), alternate sources of cooling water were not a viable option for most, if not all, facilities (see DCN 6631). Similarly, EPA did not consider

any regulatory analyses or alternatives that relied on alternative cooling water sources." While there are a few power plants with a CCRS, such as Palo Verde in Arizona that make use of water from wastewater treatment plants as makeup for the CCRS, such facilities were designed from the beginning for use of that water.

The closest Wastewater Treatment Plant (WWTP) to LHSES is in Garland, TX. However, this facility has a treatment capacity of only 34 mgd and thus could only reduce use of LHSES cooling by 5.5%. While both Dallas's Central Wastewater Treatment Plant and Southside Wastewater Treatment Plant could potential provide a significant amount of wastewater for cooling (i.e., the Central Wastewater Treatment facility averages 100 mgd) both facilities are located approximately 15 miles from LHSES and piping would have to cross many roads and residential properties (Figure 10-3) and therefore use of water from these facilities is not considered feasible. This is especially the case given that LHSES has a capacity utilization <10%.

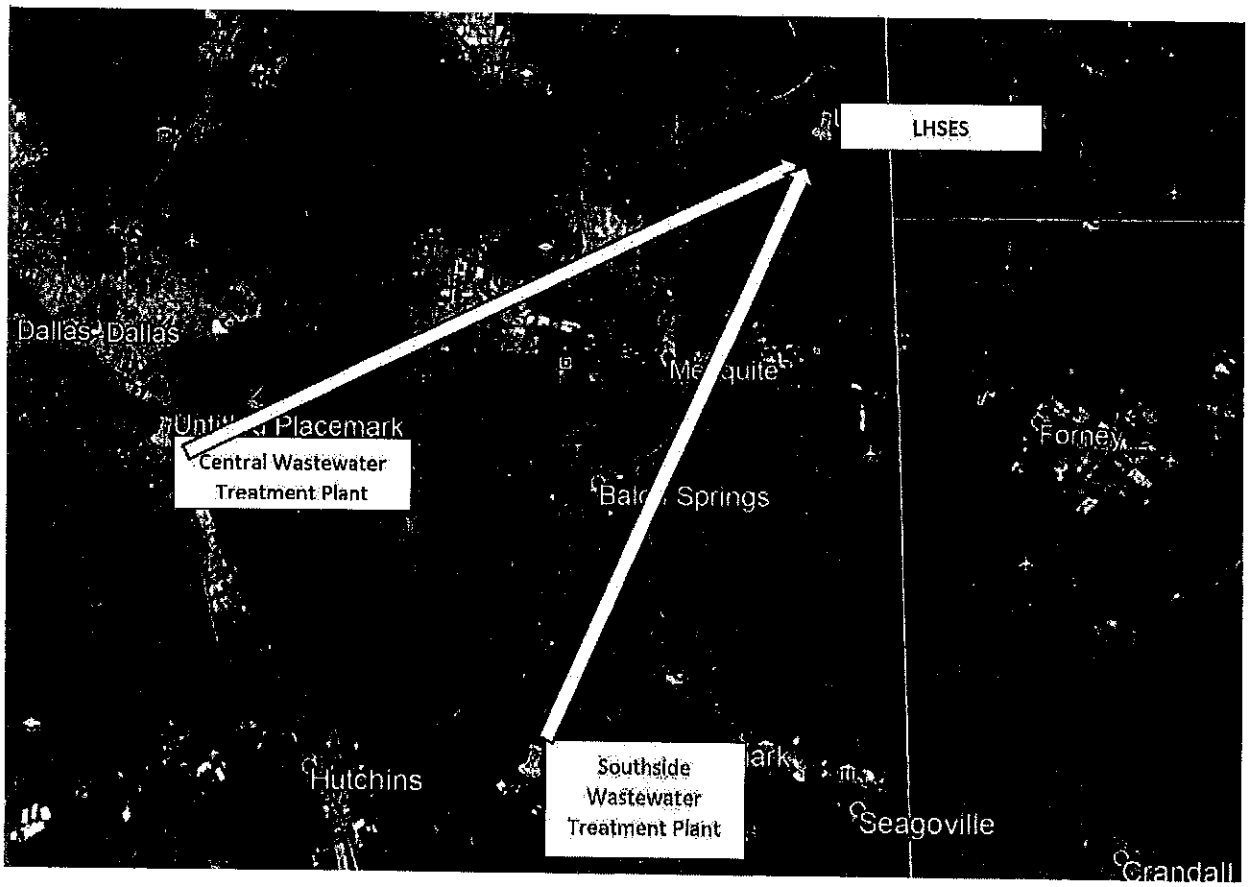

Figure 10-3 – Larger wastewater treatment facilities near LHSES

10.2.5.2 Benefits of Evaluated Technologies

There are not likely to be any significant benefits for the evaluated entrainment reduction technologies based on the facts that include:

1. LHSES currently uses a CCRS,

2. under current operations LHSES is significantly reducing flow, and
3. expected biological benefits that are significantly lower than the cost for any technology.

Each of the factors is discussed separately

10.2.5.2.1 LHSES's Use of a CCRS

Luminant provided information to TCEQ that LHSES operates a CCRS as defined in the Rule at § 125.92(c)(2) and based on that information TCEQ acknowledged it agreed in a letter dated September 2, 2015. Relative to use of a CCRS, the Rule preamble makes the following statements:

1. *"Closed-cycle cooling is indisputably the most effective technology at reducing entrainment." (pg. 48342, column 1, 14 lines from bottom of the page)*
2. *"EPA concluded that site-specific proceedings are the appropriate forum for weighing all relevant considerations in establishing BTA entrainment requirements. Closed-cycle cooling is indisputably the most effective technology at reducing entrainment. Closed-cycle reduces flows by 95 percent and entrainment is similarly highly reduced."* (pg. 48344, column 1, last paragraph)
3. *"EPA agrees that facilities employing a closed-cycle recirculating system for entrainment should also be deemed in compliance with the impingement mortality standard, as long as the system is properly operated. While a closed-cycle recirculating system is the most effective technology for reducing entrainment, EPA has not established BTA based on closed-cycle cooling because EPA concluded it was not BTA, for the reasons specified in Section VI." Regarding the definition of closed-cycle cooling...*(pg. 48355, Column 3, Response at bottom of page)
4. *"The cost estimates reflect the incremental costs attributed only to this final rule. For example, facilities already having closed-cycle recirculating systems as defined at § 125.92 will meet the impingement mortality and entrainment standards of today's rule and, therefore, will not incur costs to retrofit new technologies."* (48384, column 1, first full paragraph)

The EPA in the Rule Preamble states that properly operated CCRSs in freshwater can achieve a flow reduction of 97.5% (pg. 38338, column 3, last paragraph). Since, as discussed in 9.2.5.1.1 of this document, LHSES employs a CCRS that meets the Rule's definition at § 125.92(c)(2) of the Rule and that in EPA's opinion is *"indisputably the most effective technology at reducing entrainment"*, LHSES should be determined to employ BTA for entrainment on this basis alone.

10.2.5.2.2 Flow Reduction under Current Operations

As noted in Section 2 of the Rule LHSES's AIF over the past three years is 119.9 MGD and capacity utilization over the past five years is 8.5%. EPA in the Rule states that *"Flow reduction is commonly used to reduce impingement and entrainment. For purposes of this rulemaking, EPA assumes that entrainment and impingement (and associated mortality) at a site are proportional to source water intake volume. Thus, if a facility reduces its intake flow, it similarly reduces the amount of organisms subject to impingement and entrainment.[48]"* The result is that under current operations has reduced flow by 79.4%. The flow reduction of 79.4% means there

is a significant reduction in entrainment from Lake Hubbard Reservoir. As required by the Rule, capacity utilization and flow must be updated at each permit renewal and may change in the future.

10.2.5.2.3 Expected Biological Benefits Relative to Cost

Based on the current health of the Lake Hubbard fishery based on the most recently available TWPS 2013 fishery survey and current LHSES operations, the cost of the evaluated technologies is expected to be wholly disproportionate relative their biological benefits. With regard to the Clean Water Act (CWA), the idea of weighing costs relative to benefits appears in Section 304(b)(1)(B) of the Act, referring to effluent limitation guidelines. The actual phraseology of "wholly disproportionate" as rendered in the judicial history states that *"[t]he balancing test between total cost and effluent reduction benefits is intended to limit the application of technology only where the additional degree of effluent reduction is wholly out of proportion to the costs of achieving such marginal level of reduction for any class or category of sources"* (*Kennecott v. United States EPA*). The "wholly disproportionate cost test" was first applied to Section § 316(b) during *In the Matter of Public Service Company of New Hampshire* 10 ERC 1257 (May and Van Rossum 1995) and in the decision for that case, the sole basis for applying the "wholly disproportionate" cost test came from the aforementioned legislative history of the CWA. The ruling stated that Section § 316(b) did not require implementation of technology whose cost was "wholly disproportionate" to its environmental benefits.

10.3 Factors That May Be Considered

Each of the five factors that **may be considered** in making the entrainment BTA determination are discussed below.

10.3.1 Entrainment Waterbody Impacts

The Rule states for this factor "*(i) Entrainment impacts on the waterbody;"* – No site-specific entrainment study was conducted in the Lake Hubbard Reservoir, since LHSES's AIF is <125 MGD, as well as the fact that the facility qualifies for the § 122.21(r) information waiver as discussed in Chapter 4 of this document. As noted in Chapter 4 and the most recent TPWD monitoring report there is no indication that LHSES is having a significant impact on the Lake Hubbard Reservoir fishery. 10.3.2 Thermal Discharge Impacts

The Rule states for this factor "*(ii) Thermal discharge impacts;* - As discussed in subsection 10.2.1, TCEQ has acknowledged in the September 2, 2015 letter to Luminant that one of the reasons for the construction of the Lake Hubbard Reservoir was to provide cooling water to LHSES and meets the definition of a CCRS under the Rule's definition at § 125.92(c)(2).
The Rule states for this factor "*(ii) Thermal discharge impacts;* - As discussed in subsection 5.2.1, TCEQ has acknowledged in the September 2, 2015 letter to Luminant that one of the reasons for the construction of the Lake Hubbard Reservoir was to provide cooling water to LHSES and the reservoir meets the definition of a CCRS under the Rule's definition at § 125.92(c)(2).

10.3.3 Credit for Retired Unit Flow Reductions

The Rule states for this factor "*(iii) Credit for reductions in flow associated with the retirement of units occurring within the ten years preceding October 14, 2014;* - No units were retired at LHSES prior to October 14, 2014.

10.3.4 Impacts on Energy Delivery

The Rule states for this factor "*(iv) Impacts on the reliability of energy delivery within the immediate area;* - If Luminant were required to install a mechanical or natural draft cooling tower at LHSES it would most likely be retired. As a result, another less economical unit(s) would need to provide the electric power currently provided by LHSES resulting in a higher cost of electricity to the consumer.

10.3.5 Impacts on Water Consumption

The Rule states for this factor "*(v) Impacts on water consumption;*" - Water availability is limited in most of Texas, including the Trinity River watershed. Water for the site and reservoir is authorized by a contract with the City of Dallas which has a Certificate of Adjudication (e.g., water right) which limits the volume of water that can be stored, used, and consumed for cooling. Any additional consumptive use of water would require additional water rights or contracted water. There are not, however, any non-interruptible water rights available in the Trinity watershed, and contracted water from the Trinity River Authority and/or the City of Dallas are severely limited in both quantity of water and duration of the contract.

The estimated 50-100% increase in consumed water associated with conversion to a cooling tower will be compounded by the need for additional water treatment for the blowdown wastestream. This is because of the moderate high total dissolved solids found in the Trinity River and the concentrating effect of the cooling tower, and the fact that any discharge would be back into the reservoir.

10.3.6 Availability of Other Cooling Water Sources

Due to the significant amount of water needed for condenser cooling at LHSES (i.e., 617.8 mgd), As discussed in Subsection 10.2.5.1.3 there are no long-term/cost effective water sources within reasonable proximity to LHSES to make this alternative feasible.

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A TCEQ CCRS APPROVAL LETTER

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

September 2, 2015

Mr. David P. Duncan, Director, Environmental Generation
Environmental Services
Luminant Power
1601 Bryan Street
Dallas Texas 75201

Re: Request for approval of determination of closed-cycle recirculating system relevant to the Clean Water Act 316(b) requirements for Luminant Power Lake Ray Hubbard Reservoir

Dear Mr. Duncan:

This letter is in response to your letter dated August 17, 2015 requesting approval of a designation of a closed-cycle recirculating system (CCRS) as stipulated in 40 Code of Federal Regulations (CFR) §125.92(c) for Lake Ray Hubbard Reservoir.

The documentation submitted with the request includes the following:

(1) cover letter including information on Lake Ray Hubbard Reservoir;

(2) the Certificate of Adjudication for water rights issued by the TCEQ to the City of Dallas with the most recent Amendment granted on January 21, 1983 indicating that the reservoir was built for industrial cooling water purposes;

(3) A letter dated August 12, 2015 from the City of Dallas indicating that one of the original reasons for construction of the Lake Ray Hubbard Reservoir was to provide industrial cooling water for a power plant with an accompanying contract between the City of Dallas and Dallas Power and Light Company (predecessor of Luminant Energy) to substantiate the letter; and,

(4) a statement in the cover letter indicating that the reservoir cooling system is designed to minimize make-up flows and, because it is a reservoir system, essentially eliminates blowdown and drift as required in 40 CFR §125.92(c).

Based upon the information provided and in accordance with 40 CFR §125.92(c), Lake Ray Hubbard Reservoir is approved for designation as a CCRS relevant to compliance with the Federal Clean Water Act 316(b) regulation.

Please be advised that, at this time, the approval of a designation for a CCRS for Lake Ray Hubbard Reservoir only indicates that this CCRS system meets Best Technology Available (BTA) for impingement as identified in 40 CFR §125.92. BTA for entrainment will be addressed at a later time.

Additionally, approval of Lake Ray Hubbard Reservoir as a CCRS does not address information requirements to be submitted with a wastewater discharge permit application outlined in 40 CFR §122.21(r). Based upon Lake Ray Hubbard Reservoir being approved as a CCRS, you may request, under separate letter, some, or all, of the application information requirements in 40 CFR §122.21(r) be waived.

If you have any questions or comments regarding the contents of this letter please contact me at 512-239-4591 or via email at Lynda.Clayton@tceq.texas.gov.

Sincerely,

Lynda Clayton, Team Leader
Water Quality Assessment Team
Water Quality Division
Texas Commission on Environmental Quality

LC/ml

cc: ✓ Mr. Gary Spicer, Environmental Services, Luminant Power, 1601 Bryan Street Dallas Texas 75201

B LHSES SOURCE WATERBODY BIOLOGICAL INFORMATION

FREESE AND NICHOLS

Innovative approaches
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LAKE HUBBARD STEAM ELECTRIC STATION

316(b) BIOLOGICAL INFORMATION

Prepared for:

EPRI

March 2019

Prepared by:

FREESE AND NICHOLS, INC.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109
817-735-7300

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1.0 INTRODUCTION

Hubbard Steam Electric Station (LHSES) is located on the west shore of Lake Ray Hubbard in Dallas County, Texas. Lake Ray Hubbard was built on the East Fork Trinity River in 1969 (TWDB, 2019). The impoundment is 20,947 acres with a volume of 439,559 acre-feet at conservation pool elevation (TWDB, 2019). The manmade reservoir is stocked and managed by the Texas Parks and Wildlife Department (TPWD), and therefore meets the basis to waive 40 CFR 122.21(r) requirements. Fisheries data are available through the TPWD Inland Fisheries performance reports. Data from the TPWD 2016 fishery survey were used to describe fish species that occur in Lake Ray Hubbard (TPWD, 2017).

2.0 SPECIES NEAR LAKE HUBBARD STEAM ELECTRIC STATION COOLING WATER INTAKE STRUCTURE

TPWD (2017) states the most important sport fishes in Lake Ray Hubbard include Largemouth Bass (*Micropterus salmoides*), Channel Catfish (*Ictalurus punctatus*), Blue Catfish (*I. furcatus*), White Bass (*Morone chrysops*), hybrid striped bass (*M. chrysops* x *M. saxatilis*), and Crappie (*Pomoxis* spp.). Important forage fish include shad (*Dorosoma* spp.) and sunfish (*Lepomis* spp.) . Table 1 provides a list of the most common species that would occur near the LHSES cooling-water intake structure (CWIS).

Gizzard Shad (*D. cepedianum*), Threadfin Shad (*D. petenense*), and sunfish are considered forage species and are the most common taxa by number in most lakes. Shad are pelagic with pelagic early life stages that would likely occur near the CWIS. Shad begin spawning in the spring, with rising temperatures (Baglin and Kilambi, 1968; Bodola, 1966). Threadfin Shad may spawn from spring through fall (Carlander, 1969). Eggs are broadcast in open water or over substrates. After hatching, shad are generally pelagic, but can be found throughout the reservoir. The latest fisheries survey documented high densities of Gizzard and Threadfin shad have an Index of Variability of 83, indicating that most shad are of available size for predatory fish (TPWD, 2017).

Sunfish, including Bluegill (*Lepomis macrochirus*), Redear Sunfish (*L. microlophus*), and Longear Sunfish (*L. megalotis*), are among the most common sunfish species in the area. Sunfish are generally associated with littoral habitats and may occur near the CWIS. Peak spawning of most sunfish is in the spring or early summer, although spawning may occur from March through September (Thomas et al., 2007). Sunfish spawn in nests located in littoral habitats where they offer parental protection of eggs and larvae. In 2014,

Sunfish numbers appear to be stable, with little change in electrofishing catch rates over recent surveys (TPWD, 2017).

Crappie and Largemouth Bass are predators common to reservoirs in the region. These species generally occupy littoral habitats but can also utilize offshore structures. Crappie and Largemouth Bass have similar spawning habits. Their spawning is generally limited to the spring, when most spawning occurs in March and April (Schloemer, 1947; Lee, 1980). Both species spawn in nests in littoral habitats where they offer parental protection of eggs and larvae. Surveys over the past decade indicate that Largemouth Bass catch-per-unit-effort (CPUE) is highly variable from year to year, ranging from 76/hour (2014) to 291/hour (2015). Similarly, Black and White crappie trap net CPUE also varies broadly. Surveys indicate an approximate even mix between the two species (TPWD, 2017).

Table 1: Fish Species of Likely Occurrence in Lake Ray Hubbard [a]

Common Name	Scientific Name	Entrainment Probability [b]	Impingement Probability [c]
PELAGIC			
Gizzard Shad	*Dorosoma cepedianum*	H	H, L[d]
Threadfin Shad	*Dorosoma petenense*	H	M
BANK/STRUCTURE			
Crappie	*Pomoxis* spp.	L	L
Largemouth Bass	*Micropterus salmoides*	L	L
White Bass	*Morone chrysops*	L	L
Sunfish	*Lepomis* spp.	M	M, L[e]
BENTHIC			
Blue Catfish	*Ictalurus furcatus*	L	L
Channel Catfish	*Ictalurus punctatus*	L	L

H = High likelihood; M = Moderate likelihood; L = Low likelihood

[a] Species of likely occurrence based on fishery survey of Lake Ray Hubbard (TPWD, 2017)

[b] Entrainment Probability refers to larvae, and post-larvae passing through standard 3/8-inch mesh screen

[c] Impingement Probability refers to juvenile/adult life stages of fish impinged on standard 3/8-inch mesh screen

[d] For Gizzard Shad, impingement probability is high for juveniles and low for adults

[e] For sunfish species, impingement probability is moderate for juveniles and low for adults

White Bass are another popular sport fish in Lake Ray Hubbard. Adults are generally found among offshore pelagic environments. The movement of the species is dependent on water temperature, pursuit of prey, and spawning activity. Spawning typically occurs late February to late April with 12–20 degrees Celsius water temperatures; however, warmer cooling water effluent can accelerate spawning (Webb and Moss, 1968). White Bass often move upstream into creeks to spawn in shallow water. Demersal and adhesive,

eggs sink and attach to submerged structure like plants, logs, gravel or rocks (Balon, 1981). White Bass are non-nest guarders, and adults return to deeper water once spawning is complete (Riggs, 1955). White Bass CPUE has remained relatively stable over recent survey periods, ranging from a low of 1.9/net night in 2017 to a high of 9.9/net night in 2015 (TPWD, 2017). Palmetto Bass are a hybrid species created by crossing female Striped Bass and male White Bass; the resulting fish are sterile and require repeated stocking to maintain the population. Palmetto Bass CPUE over the past decade has ranged from a low of 0.1/net night in 2011 to 3.4/net-night in 2017.

Channel Catfish and Blue Catfish are common littoral and bottom-dwelling species in the region. They can be found throughout the reservoir but are generally associated with structure. Both species spawn during the late spring through early summer (Burgess, 1989) and deposit eggs in cavities, such as undercut banks and brush piles. The males guard the eggs and fry, and both species are popular among recreational anglers. Fisheries surveys showed stable populations of Channel Catfish and Blue Catfish, with comparable densities of both species (TPWD, 2017).

3.0 SPECIES AND LIFE STAGES SUSCEPTIBLE TO IMPINGEMENT AND ENTRAINMENT

The species most susceptible to impingement and entrainment in Lake Ray Hubbard include Threadfin Shad, Gizzard Shad, and sunfish. These species have life histories that could interact with the CWIS.

Gizzard and Threadfin shad have high fecundity rates, and spawning is often synchronous where large numbers of eggs are broadcast over wide areas. Although most eggs are broadcast over littoral substrates, the larvae are pelagic and succumb to the currents of water. Peak entrainment occurs in the spring, although shad spawning can occur through the fall. The influence of cooling water effluent can create two separate spawning events in the same year. Thus, the primary period of reproduction with the highest larval recruitment would be both during the spring and fall. Impingement of healthy shad is generally uncommon; however, Threadfin Shad can be intolerant of cold temperatures, where they can become lethargic and impinge at CWIS. During sever cold weather, Gizzard Shad may also become lethargic. Shad can also be sensitive to changes in water quality (e.g., low dissolved oxygen), which may trigger impingement.

Sunfish (*Lepomis* spp.), Largemouth Bass, and crappie share similar spawning habits. These species deposit demersal eggs in guarded nests among shallow, littoral habitats. Young fish, including larvae and sub-

adults, are generally associated with littoral cover, such as aquatic vegetation, rocks, and flooded timber. Since these species deposit demersal eggs in nests, entrainment of eggs is unlikely. Once hatched, the males generally provide some parental protection, helping to prevent the drift of larvae and possible entrainment. However, if habitat is suitable near CWIS, some entrainment of fry can occur.

Similar to larvae, juvenile sunfish, Largemouth Bass, and crappie generally reside in littoral habitats with cover. However, as the fish age, their mobility increases, which may increase the chance of interacting with CWIS. Depending on the amount of cover near the CWIS, some impingement of these species can occur.

White Bass migrate upstream into reservoir tributaries to spawn. Therefore, abundance of juvenile life stages and year-class strength can be related to spring stream flows, which can be highly variable in Texas.

Since White Bass generally spawn in upstream tributaries and release demersal, adhesive eggs, the probability of egg entrainment is expected to be low. Newly-hatched larvae can be carried with the currents of water into the pelagic zone of the reservoir, where they generally spend the rest of their life. At Lake Ray Hubbard, the primary upstream spawning areas are far from the CWIS and the probability of larval entrainment would be low. As juvenile White Bass move among pelagic areas, it is possible that some impingement could occur. However, White Bass are strong swimmers and impingent of healthy White Bass is expected to be low.

The location of catfish spawning sites in cavities within littoral habitats makes this species much less susceptible to impingement or entrainment at any life stage. Eggs are bound in adhesive masses and incubated inside cavities, away from flows associated with CWIS. Once hatched, the males generally guard the fry until their swimming ability increases. If a spawning cavity is near the CWIS, entrainment of fry could be possible, but generally uncommon. Juvenile Blue Catfish can be pelagic and impingement of this life stage can be possible.

4.0 SPECIES OF REGULATORY INTEREST

Commercial fishing is not allowed on Lake Ray Hubbard, therefore there are no commercially important species in the reservoir. Gamefish include Largemouth Bass, White Crappie, Black Crappie, and White Bass. Five bird species are federally listed as threatened or endangered for the Lake Ray Hubbard area, which includes Dallas, Rockwall, Collin, and Kaufman counties (Table 2) [USFWS, 2019]. In addition, there are no aquatic species federally listed as threatened or endangered that occur in the reservoir, and no

critical habitats occur within the Lake Ray Hubbard area. The following sections describe the bird species in relation to the Hubbard power plant.

Table 2. Federally Listed Species in Lake Ray Hubbard Area

Common Name	Scientific Name	Federal Status*	Potential Habitat in Lake Area	Affected by Normal Operations
BIRDS				
Red Knot	*Calidris canutus rufa*	T	Yes	No
Piping Plover	*Charadrius melodus*	T	Yes	No
Golden-cheeked Warbler	*Setophaga chrysoparia*	E	No	No
Whooping Crane	*Grus americana*	E	Yes	No
Interior Least Tern	*Sternula antillarum*	E	Yes	No

Source: USFWS (2019).

* T = Threatened; E = Endangered

4.1 RED KNOT

The red knot (*Calidris canutus rufa*) is a medium-sized, stocky, short-necked sandpiper with a short, straight bill. The *rufa* subspecies, one of three subspecies occurring in North America, has one of the longest distance migrations known, travelling between its breeding grounds in the central Canadian Arctic to wintering areas that are primarily in South America (USFWS, 2014a). During migration and winter in Texas, red knots may be found feeding in small groups on sandy, shell-lined beaches, and to a lesser degree, on flats of bays and lagoons (Oberholser, 1974). It is an uncommon to common migrant along the coast, and rare inland, primarily in the eastern half of the state. Red knots are very rare summer visitors and are rare and local winter residents on the coast (Lockwood and Freeman, 2004). The wintering population in Texas, with the largest numbers occurring on the Bolivar flats, was once of the order of 3,000 during 1985 through 1996, but has recently declined (USFWS, 2007). Recent eBird (2019a) data show a sighting of one red knot approximately 28 miles northwest Lake Ray Hubbard at Lake Lewisville in January of 2018. There are no recorded sightings of red knot at Lake Ray Hubbard and the likelihood of this species occurring is low due to the lack of available habitat. No critical habitat has been designated for this species.

4.2 PIPING PLOVER

The piping plover (*Charadrius melodus*) is a small shorebird that inhabits coastal beaches and tidal flats (Elliott-Smith and Haig, 2004). Approximately 35 percent of the known global population of piping plovers

winter along the Texas Gulf coast, where they reside 60 to 70 percent of the year (Campbell, 2003). The piping plover population that winters in Texas breeds on the northern Great Plains and around the Great Lakes. The species is a rare to uncommon migrant and winter resident in coastal areas of south Texas (Lockwood and Freeman, 2004). No potential habitat occurs within the aquatic environment of Lake Ray Hubbard; however, potential stopover habitat exists on exposed islands/bars and along the shoreline. The species would almost exclusively use lake shoreline habitat during migration periods for a few days at a time before continuing their journey. eBird (2019b) data shows a piping plover sighting at Lake Ray Hubbard in May 2013 on the west side of the lake near Wynn Joyce Park. The piping plover was seen alongside many other migratory shorebird species likely using the lake for a stopover during migration. While the species has been seen previously in the area, the chance of seeing it again is still low due to its rarity and the lack of exposed sandy shoreline at Lake Ray Hubbard. Critical habitat has been designated for this species; however, it does not exist at any inland Texas locations.

4.3 GOLDEN-CHEEKED WARBLER

The golden-cheeked warbler (*Setophaga chrysoparia*) is federally listed as endangered and migrants reside in habitats consisting mainly of dense, mature ashe juniper mixed with various oak species. This woodland habitat typically grows on limestone hills and canyons of central Texas. Golden-cheeked warblers are summer residents, generally restricting their range to their preferred breeding habitat (Lockwood and Freeman, 2004). eBird (2018c) data confirm golden-cheeked warbler activity approximately 30 miles southwest of Lake Ray Hubbard at the Dogwood Canyon Audubon Center near Joe Pool Lake, where habitat is present. Due to the lack of suitable, unfragmented habitat adjacent Lake Ray Hubbard, the golden-cheeked warbler is not likely to occur nearby.

4.4 WHOOPING CRANE

The whooping crane (*Grus americana*) is the tallest bird in North America and is recognized for its distinctive call and white plumage. The species was federally listed as endangered on March 11, 1967 (32 *Federal Register* 4001, USFWS, 1967). Threats to whooping cranes include habitat loss, powerline collision, illegal hunting, and general human disturbances (Canadian Wildlife Service and USFWS, 2007). Currently, there are several populations of whooping cranes, including migratory and non-migratory experimental populations in Louisiana and Florida. The Texas migratory population breeds and nests in Wood Buffalo National Park in Alberta, Canada during the summer and flies south to Aransas National Wildlife Refuge (NWR) near Rockport, Texas, on the Texas Gulf coast (USFWS, 2017). A pair of whooping cranes was

spotted at Lake Ray Hubbard in May 2013 (eBird, 2019d). Sightings near large bodies of water, agriculture fields, and near wetlands are not uncommon during migratory season within the flight path. Lake Ray Hubbard is in the potential flight path for migrating whooping cranes and the birds could use the reservoir as a temporary stopover location before continuing to the coast, like the sighting in 2013. However, the birds would likely stay in the area briefly to rest or avoid bad weather before continuing their journey. Critical habitat has been designated for this species; however, it does not exist at any inland Texas locations.

4.5 INTERIOR LEAST TERN

Two breeding populations, one coastal and the other inland, are considered separate subspecies of the least tern (*Sternula antillarum*). It is the interior population of the least tern that is listed as an endangered species (USFWS, 2014b). Any nesting birds at least 50 miles or greater from the coastline are considered interior least terns. In Texas, the interior least tern is known to breed north along the Red River, along the Canadian River in the Texas Panhandle, and among northeast Texas reservoirs (Lockwood and Freeman, 2004). Least terns are the smallest member of the gull and tern family at around 8 to 9 inches long. They nest on barren to sparsely vegetated sandbars along rivers, sand/gravel pits, reservoir shorelines, and occasionally on gravel rooftops. Recent eBird (2019e) data show multiple sightings from Lake Ray Hubbard, and most recently in July 2018. The likelihood of this species occurring at Lake Ray Hubbard is moderate, depending on reservoir elevation. The interior least turn could use exposed reservoir shoreline habitat when the pool elevation is below normal. Despite a moderate potential for the occurrence of this species at Lake Ray Hubbard, normal plant operations are not expected to affect the bird species. No critical habitat has been designated for this species.

4.6 SPECIES CONCLUSIONS

While protected species have potential to occur within the Lake Ray Hubbard area, there is no nexus between any of the federally listed bird species and the LHSES cooling water intake structure. No critical habitat for any federally listed species occurs within or in the area of the Ray Hubbard reservoir or any upstream tributaries. Normal plant operations are not expected to have any effect on the listed bird species.

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C LHSES 2015 FISHERIES MONITORING REPORT

PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-6

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2015 Fisheries Management Survey Report

Hubbard Creek Reservoir

Prepared by:

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and
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Inland Fisheries Division
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Abilene, Texas

TEXAS PARKS & WILDLIFE

SPORT FISH RESTORATION

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July 31, 2016

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Hubbard Creek Reservoir were surveyed by electrofishing and trap netting in 2015, and gill netting in 2016. Historical data are presented with the recent data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Hubbard Creek Reservoir is a 15,250-acre impoundment constructed in 1962 on Sandy Creek and Hubbard Creek, in the Brazos River Basin. The reservoir is used for municipal water supply, flood control, and recreation. The reservoir is controlled by the West Central Texas Municipal Water District and has a history of extreme water level fluctuations. Hubbard Creek was nearly full in 2008 but dropped to record low water level in May 2015. Fish habitat in the most recent survey consisted of smartweed, flooded terrestrial vegetation, salt cedar, and standing timber. Since the last survey period, boater access was limited to one public boat ramp. As of April 2016, all boat ramps were useable after a substantial water level increase from heavy rains. Bank-fishing access was limited to the boat ramp areas as well as near the US-180 Bridge.

- **Management History:** Important sport fish include Largemouth Bass, White Bass, White Crappie, and catfishes. Sport fishes are regulated by statewide harvest regulations. Threadfin Shad were introduced in 1984. Channel Catfish were introduced in 1970. Palmetto Bass were stocked in 1979 and 1984. Florida Largemouth Bass were introduced in 1979, stocked during the early 1990's, stocked in 2003, and they were last stocked in 2011 and 2012.

- **Fish Community**
  - **Prey species:** Electrofishing catch of prey species was low and consisted primarily of Gizzard Shad, Bluegill, and Longear Sunfish. Other fish species were also available as prey. Sunfish species were of sizes that were available to most sport fish. Gizzard Shad < 7 inches were present in high relative abundance and were available to most sport fish.

  - **Catfishes:** Channel Catfish, Blue Catfish, and Flathead Catfish were present in the reservoir. Blue Catfish were the most abundant catfish species observed during gill net surveys. Most of the Blue Catfish were of harvestable size.

  - **White Bass:** In 2016, White Bass relative abundance was low, and all fish sampled were harvestable size.

  - **Largemouth Bass:** In 2015, Largemouth Bass relative abundance and number of large fish were low. Legal-sized fish were not relatively abundant in the survey.

  - **White Crappie:** In 2015, White Crappie relative abundance was low. Mean relative weight for most inch classes ranged from 90-110. Legal-sized White Crappie were not relatively abundant in the survey.

Management Strategies: Largemouth Bass and prey items will be surveyed in fall 2017. Trap netting, gill netting, and electrofishing surveys will be conducted in 2019-2020 for relative abundance, size structure, and mean relative weight data. Access and habitat surveys will be conducted in summer 2019. Inform the public of the threat and impact of invasive species.

INTRODUCTION

This document is a summary of fisheries data collected from Hubbard Creek Reservoir in 2015-2016. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2015-2016 data for comparison.

Reservoir Description

Hubbard Creek Reservoir is a 15,250-acre impoundment constructed in 1962 on Sandy Creek and Hubbard Creek, in the Brazos River Basin. Hubbard Creek Reservoir is located in Stephens County approximately 55 miles northeast of Abilene, Texas and is controlled by the West Central Texas Municipal Water District. The reservoir was built primarily for municipal water supply, flood control, and recreation. Hubbard Creek Reservoir experienced long periods of reduced water level. From 1999 to 2007, the water level fluctuated from approximately 4.3 to 19.0-feet below conservation pool (CP). Water level was within 0.5-feet below CP in May 2008, but rapidly declined in years following. A historic low water level occurred in May 2015 when water level was approximately 31.0-feet below CP (Figure 1). During 2015 sampling, water level varied from 14.1 to 18.3-feet below CP. As of June 2016, Hubbard Creek Reservoir was full. Other descriptive characteristics for Hubbard Creek Reservoir are in Table 1.

Angler Access

Hubbard Creek Reservoir boat access consisted of one useable public boat ramp during most of the sampling period with others out of the water. After heavy rains in spring 2016, water level increased enough so all ramps were usable. Bank-fishing access was limited to the boat ramp area and the area by the U.S. Highway 180 Bridge. Additional boat ramp characteristics can be seen in Table 2.

Management History

Previous management strategies and actions: Management strategies and actions from previous survey report (Dumont 2012) included:

1. Annually survey hydrilla, an invasive plant species, coverage in the reservoir and submit updates to controlling authority.
   Action: Annual monitoring has been completed to determine presence/absence of hydrilla and approximate coverage. Controlling authority was notified of any hydrilla findings.
2. Stock Florida Largemouth Bass in Hubbard Creek Reservoir once a substantial increase in littoral habitat has occurred.
   Action: Florida Largemouth Bass were stocked in 2012 and 2016. Genetic testing was conducted in 2015.
3. Educate the public about the threats of invasive species.
   Action: Press releases were distributed to local and statewide media. Signage was posted at Hubbard Creek Reservoir to notify users of the potential threats of invasive species.

Harvest regulation history: All sport fish are regulated with statewide harvest regulations (Table 3).

Stocking history: Threadfin Shad were stocked in 1984. Channel Catfish were stocked in 1970. Palmetto Bass were stocked in 1979 and 1984; however, stockings have been discontinued. Florida Largemouth Bass were first stocked in 1979 and were most recently stocked in 2016. The complete stocking history is displayed in Table 4.

Vegetation/habitat management history: Hydrilla was first documented in Hubbard Creek Reservoir in 1998, and the estimated coverage was 25 acres in 1999. During the next survey conducted in 2003, no hydrilla was found. However, hydrilla was found in surveys between 2008-2012, during which coverage substantially declined nearly each year. No hydrilla has been discovered since 2012. Previously, there

have not been attempts to control hydrilla at Hubbard Creek Reservoir by the West Central Texas Municipal Water District or by Texas Parks and Wildlife Department.

Water transfer: There was one permanent pumping station on the reservoir which can transfer water to Fort Phantom Hill Reservoir. No interbasin water transfers exist.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Hubbard Creek Reservoir (TPWD unpublished). Primary components of the OBS plan are listed in Table 5. All survey sites were randomly selected and all surveys were conducted according to the Fisheries Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Electrofishing – Largemouth Bass, sunfishes, and Gizzard Shad were collected by electrofishing (1.5 hours at 18, 5-minute stations in 2013 and 2.0 hours at 24, 5-minute stations in 2015). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

Trap Netting – White Crappie were collective using trap nets (15 net nights at 15 stations). CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn). Otoliths were collected from White Crappie 9.0-11.9 inches for age and growth to determine age at legal-length.

Gill netting – Channel Catfish, Blue Catfish, White Bass, and Flathead Catfish were sampled by gill netting (20 net nights at 20 stations). CPUE for gill netting was recorded as the number of fish caught per net night (fish/nn). Fish were not weighed during the gill net surveys.

Genetics – Genetic analysis of Largemouth Bass was conducted in accordance with the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005 through 2015 and by electrophoresis for previous years.

Statistics – Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD) terminology modified by Guy et al. 2007], and condition indices [relative weight (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics.

Habitat – Habitat surveys were conducted during summer 2013 and 2015. In August 2013, habitat composition was determined by assessing the habitat at 130 random stations throughout the reservoir. In July 2015, habitat was documented at 354 random stations distributed throughout the reservoir. During each survey, plants and habitat types were identified at or below the waterline and marked as "1" for present or "0" for absent. Percent occurrence (% = [# stations present / total stations sampled] X 100) and associated 95% confidence intervals were calculated for habitat. No structural habitat survey was conducted in 2015-2016 since structural features have not changed since the 2011 sampling period.

Water level – Source for water level data was the United States Geological Survey (USGS 2016).

RESULTS AND DISCUSSION

Habitat: In 2013, water level at the time of the habitat survey was 20.7-feet below CP and was 18.3-feet below CP during the 2015 habitat survey. Of the structural habitat features found in the survey, small boulders were encountered the most followed by large boulders, pebbles, cobbles, docks, rip-rap, bridge pylons, and bedrock (Table 6). Structural habitat types have a higher percent occurrence in 2013 compared to 2015 for most habitat types. Smartweed was the most prevalent of the vegetation found in

the survey. In 2015, other vegetation such as salt cedar, *Chara* sp., black willow, and cattail were also present. Percent coverage of smartweed and salt cedar increased from 2013 to 2015. Most of the reservoir consisted of non-descriptive or featureless bank in 2013 and 2015. Flooded terrestrial and standing timber were also present (Table 7). Dumont (2012) noted hydrilla, pondweed, brittle naiad, and stargrass were observed in the 2011 survey when water level was about 5-feet higher than it was during the 2015 survey. No hydrilla was observed since the 2012 survey.

Prey species: The prey base primarily consisted of Gizzard Shad, Bluegill, and Longear Sunfish. Catch rate of Gizzard Shad in 2015 had decreased to 120.0/h from 164.0/h in 2013 and 180.0/h in 2011. In 2015, IOV was high (91) compared to 2011 (64; Figure 2), indicating that the majority of Gizzard Shad were of suitable prey size for sport fish. Bluegill CPUE declined from 2011 (103.5/h) to 2013 (10.0/h). Catch rates increased in 2015 (36.0/h) compared to 2013, yet relative abundance was still lower in 2015 than in 2011. Similar patterns in CPUE-Stock were observed (Figure 3). Size structure of Bluegill consisted primarily of fish 2-4 inches, which most fish in the sample were of adequate prey size for sport fish (Figure 3).

Blue Catfish: Blue Catfish were the most relatively abundant of the catfishes sampled with gill nets. Blue Catfish catch rate was similar from 2008-2016, ranging from 2.4-3.8/nn. The relative abundance of fish ≥ 12 inches also remained similar from 2008 (1.9/nn) to 2012 (3.7/nn) and 2016 (3.0/nn; Figure 4). Most of the fish sampled with gill nets were of harvestable size and size structure was favorable for anglers as the PSD was 49. Despite additional sampling effort to collect needed fish, no Blue Catfish were collected for determining age at legal length because only two fish 11.0-13.9 inches were sampled.

Channel Catfish: Channel Catfish catch rate in the gill netting surveys remained low from 2008 (0.9/nn), to 2012 (2.4/nn) and 2016 (0.5/nn). The catch rate of fish ≥ 12 inches remained low from 2008 (0.6/nn) to 2012 (2.3/nn) and 2016 (0.5/nn). All of the fish collected were of harvestable size and size structure was favorable for anglers as PSD was 89 (Figure 5).

Flathead Catfish: Flathead Catfish were present in gill netting surveys conducted at Hubbard Creek Reservoir. Catch rates were low in 2008 (0.3/nn) and 2016 (0.3/nn).

White Bass: White Bass catch rates in gill net surveys declined from 8.0/nn in 2008 to 2.1/nn in 2012. Catch rate increased to 3.7/nn in 2016 from 2012; however, catch rate was still less in 2016 compared to 2008. Relative abundance of White Bass ≥ 10 inches was variable from 6.5/nn in 2008, 1.2/nn in 2012, and 2.0/nn in 2016 (Figure 6). Harvestable size fish were available to anglers and PSD was 58 (Figure 6).

Largemouth Bass: Electrofishing catch rate for all Largemouth Bass was 21.5/h in 2015, which was lower than the catch reported in 2013 (39.3/h) and in 2011 (93.5/h; Figure 7). Relative abundance of Largemouth Bass ≥ stock-size (≥ 8 inches) declined to 4.5/h in 2015 from 35.3/h in 2013, and from 59.0/h in 2011 (Figure 7). Relative abundance of Largemouth Bass ≥ 14 inches decreased from 24.0/h in 2011 to 2.0/h in 2015. The low water level between 2012-2015 likely reduced critical habitat and thus reduced Largemouth Bass spawning success and recruitment. No fish in the 13.0-15.9 inch size range were collected during the electrofishing survey, and age at legal length could not be determined. One Florida Largemouth Bass was sampled during 2015 electrofishing survey, and all other Largemouth Bass collected were intergrades (Table 8).

White Crappie: White Crappie CPUE in the trap net surveys decreased from 2007 (12.0/nn), to 2011 (6.8/nn), to 2015 (1.9/nn). Catch of CPUE-10 of White Crappie increased from 2.0/nn in 2007 to 2.5/nn in 2011, then decreased to 0.2/nn in 2015 (Figure 8). In 2015, PSD for White Crappie decreased to 54 from 82 and 88 reported in the 2007 and 2011 surveys, respectively. In the 2015 survey, White Crappie of legal-size were in low relative abundance. Only 6 fish between 9.0-11.9 inches were collected to determine age at legal-length in 2015. White Crappie grew to harvestable size within 0.8 years in 2015 (N=6, range = 0-1 years) and 1.4 years in 2003 (N = 21, range = 1-2 years).

Fisheries management plan for Hubbard Creek Reservoir, Texas

Prepared – July 2016

ISSUE 1: Largemouth Bass, crappie, and sunfishes populations support popular fisheries at Hubbard Creek Reservoir, and they experienced decreased relative abundance during prolonged low water conditions between 2008 and 2015.

MANAGEMENT STRATEGIES

1. Continue to monitor Largemouth Bass to determine trends in relative abundance, size structure, and body condition by conducting biennial electrofishing surveys.
2. Continue to monitor White Crappie to determine trends in relative abundance, size structure, and body condition by conducting trap net survey.
3. Determine trends in Gizzard Shad and Bluegill relative abundance and size structure by conducting biennial electrofishing.
4. Stock Florida Largemouth Bass when habitat is suitable.
5. Monitor genetic influence of fish ≤ 8 inches to determine stocking successes by collecting samples for genetic analysis during the 2017 electrofishing survey.
6. Monitor genetic influence of existing Florida Largemouth Bass by collecting samples for genetic analysis during the 2019 electrofishing survey.
7. Consider ways to improve fish habitat at low water level that would increase relative abundance of centrarchid species.

ISSUE 2: During the last survey period, Hubbard Creek Reservoir dropped to a record low water level, and only one boat ramp was usable.

MANAGEMENT STRATEGY

1. Meet with the West Central Texas Municipal Water District to discuss the potential of ramp improvement projects during periods of low water, specifically the extension of the Peeler Park Ramp.

ISSUE 3: Invasive salt cedar has extensive coverage throughout the reservoir. In July 2015, an aerial survey was conducted to document salt cedar coverage at the reservoir. Currently, control measures have not been implemented by West Central Texas Municipal Water District or Texas Parks and Wildlife Department.

MANAGEMENT STRATEGY

1. Meet with the controlling authority and consult Texas Parks and Wildlife Department invasive species experts to discuss salt cedar establishment, potential management efforts, and possible control strategies.

ISSUE 4: Golden alga (*Prymnesium parvum*) was first detected in the reservoir during fall 2014. While golden alga has not caused a fish kill at Hubbard Creek Reservoir, its existence poses a threat to sport fisheries.

MANAGEMENT STRATEGY

1. Collect periodic water samples during the cold season to monitor water quality, golden alga cell densities, and golden alga toxicity.

ISSUE 5: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches, and plugging engine cooling systems. Giant salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing, and swimming. The financial costs of controlling and/or

eradicating these types of invasive species were significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Cooperate with controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate marina owners about invasive species, and provide them with posters, literature, and other informative materials so that they can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the internet.
4. Make a speaking point about invasive species when presenting to constituents.
5. Map existing and future interbasin water transfers to facilitate potential invasive species responses.

Objective-based Sampling Plan for Hubbard Creek Reservoir

Sport fish, forage fish, and other important fishes: Main prey species in Hubbard Creek Reservoir include Gizzard Shad, Bluegill, and Longear Sunfish. Sport fish present in the reservoir include Blue Catfish, Channel Catfish, Flathead Catfish, White Bass, Largemouth Bass, and White Crappie.

Low-density fisheries: A creel survey has not been conducted at the reservoir. Thus, to deem a fishery as "negligible" would be inappropriate for this sampling plan.

Survey objectives, fisheries metrics, and sampling objectives

Prey species: Gizzard Shad, Bluegill, and Longear Sunfish comprise the majority of the prey species community in the reservoir. Prey populations have been traditionally monitored by biennial fall electrofishing surveys conducted at 24, 5-minute random stations (2 hours total). The biennial electrofishing schedule has been appropriate for monitoring prey species, and sampling will resume in fall 2017 and fall 2019 (Table 9) to collect data that will allow for monitoring large-scale changes to relative abundance and size structure. A target RSE ≤ 25 will be attempted during sampling for relative abundance data (i.e., CPUE-Total) for Gizzard Shad and Bluegill. IOV will be sampled for Gizzard Shad and Bluegill will be sampled for size structure (PSD) by collecting ≥ 50 fish. No additional sampling effort will be conducted if objectives are not met during designated Largemouth Bass sampling. Instead, Largemouth Bass body condition can provide information on prey vulnerability to predation and prey relative abundance.

Blue Catfish: Blue Catfish are managed by the statewide 12-inch minimum length limit (MLL) and 25-fish (in combination with Channel Catfish) bag limit. Antidotal evidence suggests that Blue Catfish are a popular sport fish at Hubbard Creek Reservoir. Gill netting has been used to monitor the population, which previous surveys have indicated Blue Catfish were slightly more abundant in the reservoir than Channel Catfish, but catches were low for both species. From 2008-2016, CPUE-Total had marginally increased from 2.4/nn to 3.1/nn and fish ≥12 inches slightly increased from 1.9/nn to 3.0/nn during that time period. Blue Catfish have been sampled once every four years in conjunction with Channel Catfish and White Bass sampling. Gill netting will be conducted in spring 2020 (Table 9) to maintain trend data for relative abundance and size structure. Gill netting will be conducted at 10 random stations. A target RSE ≤ 25 will be attempted for relative abundance data (CPUE-Total and CPUE-12) and a target of 50 fish ≥ stock-size (≥ 12 inches) will be collected to determine size structure (PSD). If these objectives are not achieved, 10 additional random sampling stations may be added if deemed feasible. During gill netting, 13 fish, 11-12.9 inches will be collected and used for estimating age at legal-length.

Channel Catfish: Channel Catfish are present in the reservoir and have been managed with the statewide 12-inch MLL and 25-fish (in combination with Blue Catfish) daily bag limit. Traditionally, Channel Catfish have been sampled by gill nets (with varying effort; 10-20 stations) and have been in low relative abundance in the reservoir. In the most recent surveys from 2008-2016, CPUE-Total increased slightly from 0.9/nn in 2008 (15 stations; RSE=32) to 2.4/nn in 2012 (10 stations; RSE=32) but declined to 0.5/nn in 2016 (20 stations; RSE=30). Catch of fish ≥ 12 inches increased from 0.6/nn in 2008 (15 stations; RSE=36) to 2.3/nn in 2012 (10 stations; RSE=32) but decreased to 0.5/nn in 2016 (20 stations; RSE=30). Continuation of gill netting surveys once every four years is necessary to maintain trends in relative abundance and size structure. Gill netting will be conducted during spring 2020 (Table 9) at 10 random stations to maintain trend data for relative abundance. A target RSE ≤ 25 will not be attempted for relative abundance data (CPUE-Total, CPUE-S, and CPUE-12). Due to the high number of stations needed to achieve a RSE ≤ 25 for CPUE-Total (an estimated 36 net nights) or RSE ≤ 25 for CPUE-Stock (an estimated 36 net nights) all sampling for Channel Catfish will be exploratory until catch rates and abundance increases. Due to the high number of net nights needed to achieve a target sample size of 50 fish ≥ stock-size (85 net nights; net night estimations were calculated using the 2016 gill net data), sampling for size structure will be exploratory. Catch rates using gill nets have yielded very poor catch of Channel Catfish. Tandem-hoop netting has not been conducted to sample Channel Catfish at Hubbard Creek Reservoir and could produce more precise relative abundance data and more stock-size fish sampled. Use of exploratory tandem-hoop netting to sample Channel Catfish at Hubbard Creek Reservoir

in summer 2019 will be considered if the schedule allows. During gill netting or tandem-hoop netting, 13 fish 11-12.9 inches will be collected and used for estimating age at legal-length.

Flathead Catfish: Flathead Catfish are present in Hubbard Creek Reservoir, and have been managed with the 18-inch MLL and 5-fish daily bag limit. Historically, Flathead Catfish have been monitored for presence/absence in gill net and standard electrofishing surveys. However, catch rates by use of both gear types has yielded very poor catch of Flathead Catfish. Low-frequency electrofishing has not been conducted to sample Flathead Catfish at Hubbard Creek Reservoir. Exploratory use of low-frequency electrofishing to sample Flathead Catfish will be conducted during summer 2019 (Table 9) for 1 hour at 20, 3-minute random shoreline stations. During this survey, baseline data for relative abundance (CPUE-Total, CPUE-Stock, and CPUE-18), size structure, and body condition will be obtained. Data collected during this survey will help determine if this population has adequate relative abundance to support a sport fishery.

White Bass: White Bass are managed with the statewide 10-inch MLL and 25-fish daily bag limit. Traditionally, White Bass have been sampled by gill net surveys with varying effort (10-20 stations). In the most recent surveys, 2008-2016, CPUE-Total and CPUE-Stock in 2008 were 8.0/nn (15 stations; RSE=28) then decreased to 2.1/nn in 2012 (10 stations; RSE=51) to 3.7/nn in 2016 (20 stations; RSE=35). Continuation of gill netting surveys once every four years is necessary to maintain trends of White Bass relative abundance and size structure. Gill netting will be conducted during spring 2020 (Table 9) at 10 random stations to maintain trend data for relative abundance and size structure. A target RSE ≤ 25 will not be attempted for relative abundance data (CPUE-Total, CPUE-S, and CPUE-10). Due to the high number of net nights needed to achieve a RSE ≤ 25 for CPUE-Total (an estimated 42 net nights) or RSE ≤ 25 for CPUE-Stock (an estimated 42 net nights) all sampling for White Bass will be exploratory monitoring until the population increases in abundance. (All net night estimations were calculated using 2016 gill net data.) A target sample size of 50 fish ≥ stock-size (≥ 6 inches) will be collected to determine size structure (PSD). At least 10 fish per represented inch group ≥ stock-size will be measured and weighed for estimating body condition. If these objectives for PSD and body condition are not achieved, up to 10 additional random stations may be added if deemed feasible. During gill netting, 13 fish 9-10.9 inches will be collected and used for estimating age at legal-length.

Largemouth Bass: Largemouth Bass are present and are managed with the statewide 14-inch MLL and 5-fish daily bag limit. Traditionally, Largemouth Bass have been sampled with electrofishing with varying effort 1.5-2.0 h (18-24, 5-minute stations). Largemouth Bass relative abundance decreased between 2011-2015. CPUE-Total was 93.5/h in 2011 (2.0 h; RSE=21), 39.3/h in 2013 (1.5 h; RSE=31), and 21.5/h (2.0 h; RSE=29). Catch of fish ≥ 14 inches was 24.0/h in 2011 (2.0 h; RSE=26), and 1.3/h in 2013 (1.5 h; RSE=69) and 2.0/h in 2015 (2.0 h; RSE=59). Continuation of biennial electrofishing is necessary to maintain trends of Largemouth Bass relative abundance and size structure (Table 9). During each sampling event, electrofishing will be conducted for 2 hours at 24 random 5-minute stations to assess relative abundance (i.e., CPUE-Total and CPUE-Stock). A random sample of fin clips from 30 fish ≤ 8 inches will be collected for microsatellite DNA analysis to determine prevalence of Florida and northern Largemouth Bass allele in 2017 to determine stocking success and a random sample of fin clips from 30 fish of any size will be collected for microsatellite DNA analysis to determine prevalence of Florida Largemouth Bass allele in 2019.

White Crappie: White Crappie are managed with the statewide 10-inch MLL and 25-fish daily bag limit. Traditionally, crappie have been sampled with fall trap netting with varying effort from (10-20 stations). In 2007, White Crappie CPUE-Total was 12.0/nn (10 stations; RSE=30), 6.8/nn in 2011 (10 stations; RSE=29), and 1.9/nn in 2015 (15 stations; RSE=32). Catch of fish ≥ 10 inches was 2.0/nn in 2007 (10 stations; RSE=30), 2.5/nn in 2011 (10 stations; RSE=38), and 0.2/nn (15 stations; RSE=53). Continuation of trap netting every four years is necessary to maintain tends in White Crappie relative abundance, size structure (PSD), and body condition (mean relative weight). Trap netting will be conducted in fall 2019 (Table 9) at a minimum of 10 random stations. A target RSE ≤ 25 will not be attempted for relative abundance data (CPUE-Total, CPUE-S, and CPUE-10). Due to the high numbers of stations needed to achieve a RSE ≤ 25 for CPUE-Total (an estimated 30 net nights) or RSE ≤ 25 for CPUE-Stock (an estimated 28 net nights) all sampling for White Crappie will be exploratory. Due to the high number of net

nights needed to achieve a target sample size of 50 fish ≥ stock-size (≥ 5 inches; up to 45 stations), sampling for size structure and body condition will be exploratory. (All net night estimations were calculated using 2016 trap net data.) During sampling, 13 fish, 9-10.9 inches will be collected and their otoliths will be used for age estimation at legal length and assess growth. If these objectives are not achieved, up to 10 additional random sampling stations may be added if deemed feasible.

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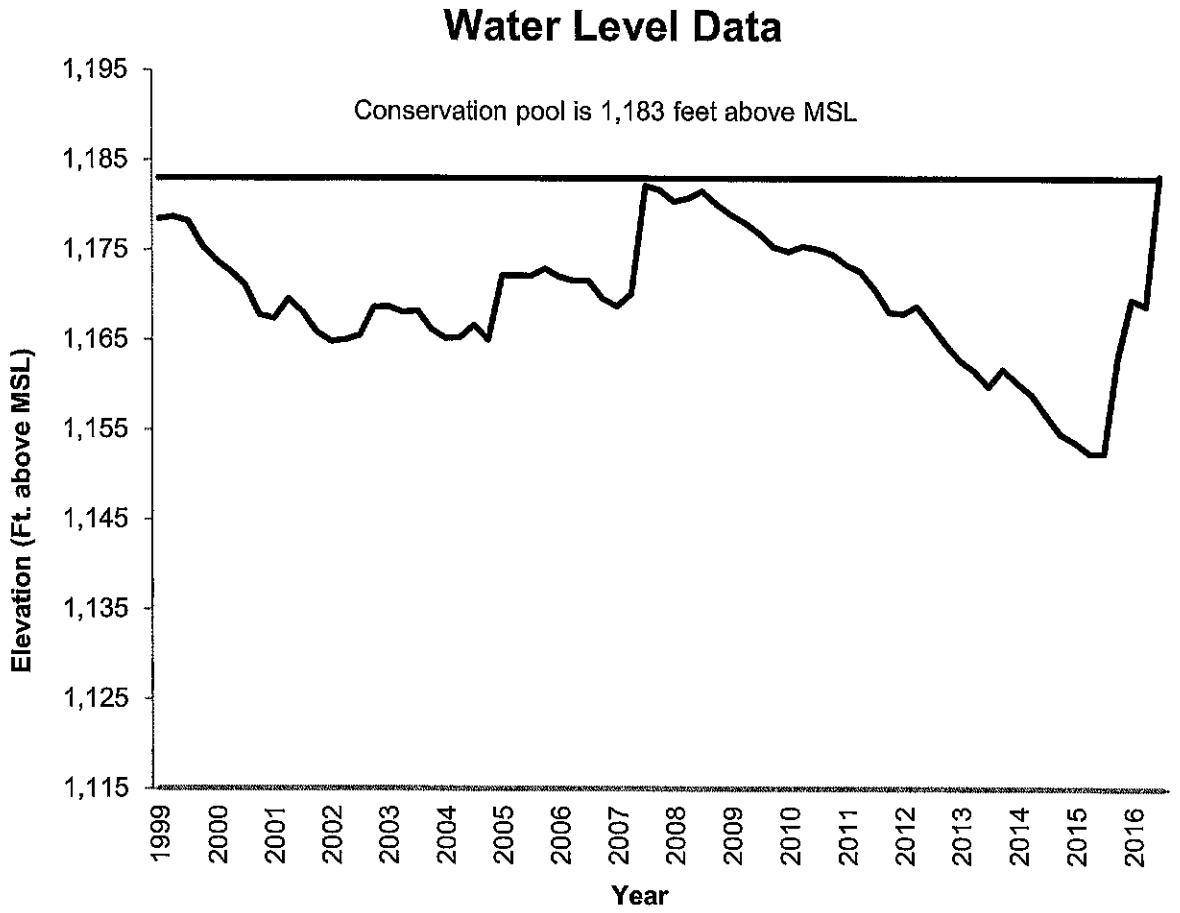


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Hubbard Creek Reservoir, Texas. Conservation pool is 1,183 feet above mean sea level, shown in red. Dead pool is approximately 1,115 feet above mean sea level.

Table 1. Characteristics of Hubbard Creek Reservoir, Texas.

Characteristic	Description
Year constructed	1962
Conservation pool	1,183 feet above mean sea level
Dead pool	1,115 feet above mean sea level
Controlling authority	West Central Texas Municipal Water District
County	Stephens
Reservoir type	Tributary
River basin	Brazos River Basin
Shoreline Development Index	8.60
USGS 8-Digit HUC Watershed	12060105 (Hubbard)
Conductivity	282-1,913 µS/cm

Table 2. Boat ramp characteristics for Hubbard Creek Reservoir, Texas, April, 2016. Reservoir elevation at time of survey was 1,174.4 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Hwy 180/ Bob Clark Landing	32.767802 -99.014456	Y	40	1,169	Good, Usable
Dam/ Paul Prater Landing	32.817885 -98.954127	Y	30	1,155	Good, Usable
Game Warden Slough/ Corley Ramp	32.836155 -98.976140	Y	20	1,170	Good, Usable
Peeler Park	32.768639 -99.073083	Y	20	1,170	Good, Usable

Table 3. Harvest regulations for Hubbard Creek Reservoir, Texas.

Species	Bag limit	Length limit
Catfish: Channel and Blue, their hybrids and subspecies	25 (In any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Largemouth	5	14-inch minimum
Crappie: White and Black, their hybrids and subspecies	25 (in any combination)	10-inch minimum

Table 4. Stocking history of Hubbard Creek Reservoir, Texas. Size categories were: ADL = Adult; UNK = unknown; FRY = < 1 inch; FGL = (fingerling) 1-3 inches.

Species	Year	Number	Size
Threadfin Shad	1984	1,500	ADL
Channel Catfish	1970	100,000	UNK
Palmetto Bass	1979	132,450	UNK
	1984	3,090,000	FRY
	Total	3,222,450	
Largemouth Bass	1967	18,000	UNK
	1968	200,000	UNK
	1971	100,000	UNK
	Total	318,000	
Florida Largemouth Bass	1979	80,425	FGL
	1986	135,500	FGL
	1990	157,265	FRY
	1990	225,834	FGL
	1991	382,989	FGL
	2003	355,520	FGL
	2011	373,397	FGL
	2012	377,199	FGL
	2016	86,842	FGL
	Total	2,174,971	

Table 5. Objective-based sampling plan components for Hubbard Creek Reservoir, Texas 2015-2016.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – Stock	RSE-Stock ≤ 25
	Abundance	CPUE – 14	RSE-14 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 14 inches	N = 13, 13.0 – 15.9 inches
	Condition	W_r	10 fish/inch group (max)
	Genetics	% FLMB	N = 30, any age
Gizzard Shad [a]	Abundance	CPUE – Total	RSE-Total ≤ 25
	Prey availability	IOV	N ≥ 50
Bluegill [a]	Abundance	CPUE – Total	RSE-Total ≤ 25
Trap netting			
White Crappie	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – Stock	RSE-Stock ≤ 25
	Abundance	CPUE – 10	RSE-10 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 10 inches	N = 13, 9.0 – 11.9 inches
	Condition	W_r	10 fish/inch group (max)
Gill netting			
Blue Catfish	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – 12	RSE-12 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
	Age-and-growth	Age at 12 inches	N = 13, 11.0-13.9 inches
Channel Catfish	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – Stock	RSE-Stock ≤ 25
	Abundance	CPUE – 12	RSE-12 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock
White Bass	Abundance	CPUE – Total	RSE-Total ≤ 25
	Abundance	CPUE – Stock	RSE-Stock ≤ 25
	Abundance	CPUE – 10	RSE-10 ≤ 25
	Size structure	PSD, length frequency	N ≥ 50 stock

[a] No additional effort will be expended to achieve survey objectives for Gizzard Shad or Bluegill if they are not reached during designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

Table 6. Comparison of the percent occurrence and associated 95% confidence levels for habitat sampled at random throughout the reservoir (N=354) in Hubbard Creek Reservoir, Texas, 2013 and 2015. Size categories were: pebbles 0.01-2.5 inches, cobble 2.5-10.0 inches, small boulders 10.0-24.0 inches, and large boulders ≥ 24.0 inches. Water level at time of survey in 2013 was approximately 20.7-feet below conservation level and was approximately 18.3-feet below conservation pool in 2015.

	2013			2015		
Structural habitat type	Percent Occurrence	Lower CL	Upper CL	Percent Occurrence	Lower CL	Upper CL
Small boulders	9.2	4.3	14.2	2.8	1.1	4.6
Large boulders	4.6	1.0	8.2	1.4	0.2	2.6
Cobbles	6.2	2.0	10.3	0.8	0.0	1.8
Pebbles				0.8	0.0	1.8
Docks				0.6	0.0	1.3
Rip-rap	1.5	0.0	3.7	0.3	0.0	0.8
Bridge pylons	0.8	0.0	2.3	0.3	0.0	0.8
Bedrock				0.3	0.0	0.8

Table 7. Comparison of the percent occurrence and associated 95% confidence levels for vegetative species/habitat types sampled at random stations throughout the reservoir (N=354) in Hubbard Creek Reservoir, Texas, 2013 and 2015. Water level at time of survey in 2013 was approximately 20.7-feet below conservation level and was approximately 18.3-feet below conservation pool in 2015.

	2013			2015		
Vegetative/species habitat type	Percent Occurrence	Lower CL	Upper CL	Percent Occurrence	Lower CL	Upper CL
Non-descriptive/featureless	71.5	63.8	79.3	65.3	60.3	70.2
Smartweed	13.1	7.3	18.9	29.9	25.2	34.7
Flooded terrestrial vegetation	2.3	0.0	4.9	14.1	10.5	17.8
Salt cedar	4.6	1.0	8.2	11.0	7.8	14.3
Standing timber	9.2	4.3	14.2	5.1	2.8	7.4
Chara sp.	6.2	2.0	10.3	2.0	0.5	3.4
Black willow				2.0	0.5	3.4
Cattail				0.6	0.0	1.3
Fallen timber	1.5	0.0	3.7			

Gizzard Shad

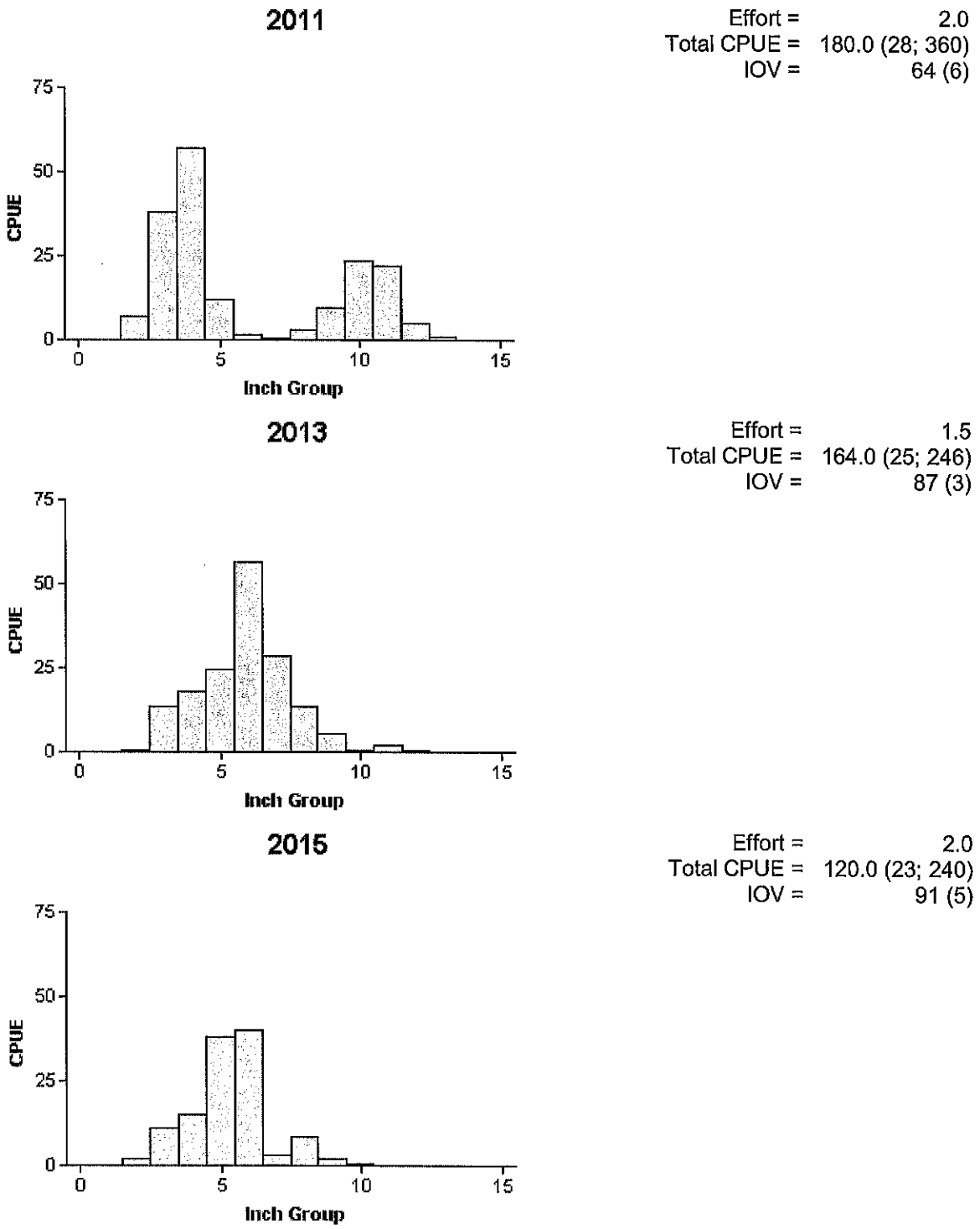
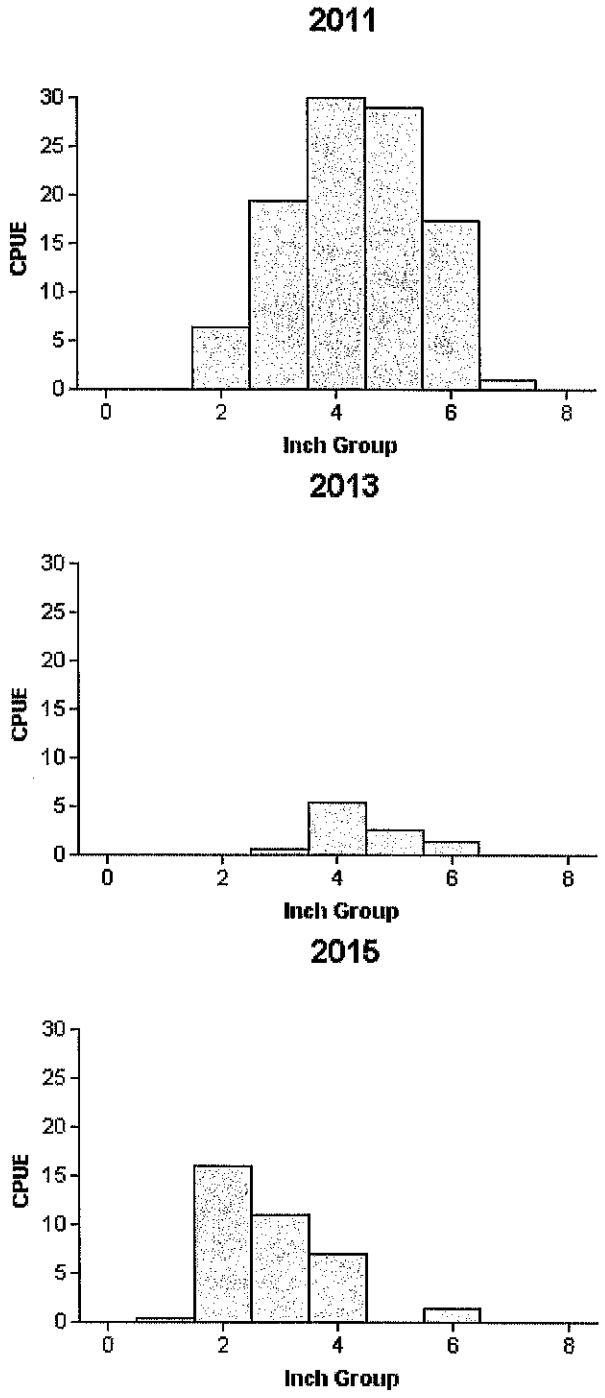


Figure 2. Comparison of the number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Hubbard Creek Reservoir, Texas, 2011, 2013, and 2015.

Bluegill



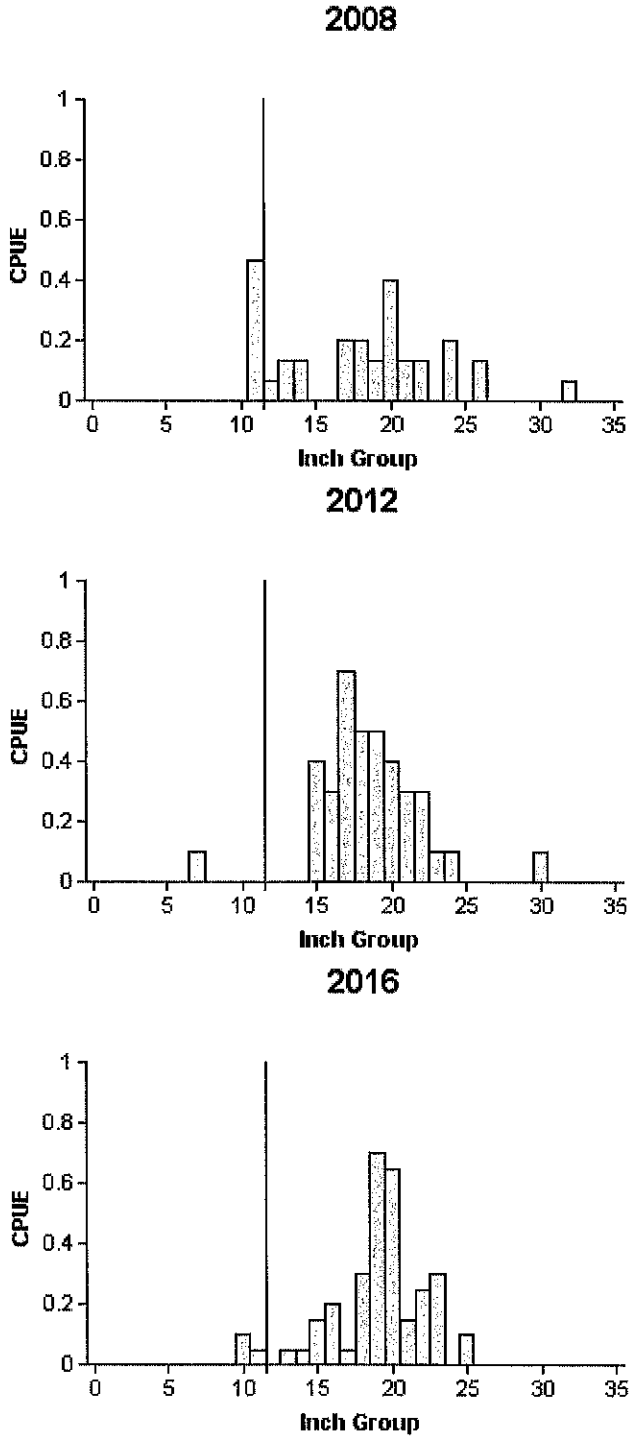
Effort =	2.0
Total CPUE =	103.5 (15; 207)
Stock CPUE =	97.0 (15; 194)
PSD =	19 (3)

Effort =	1.5
Total CPUE =	10.0 (48; 15)
Stock CPUE =	10.0 (48; 15)
PSD =	13 (9)

Effort =	2.0
Total CPUE =	36.0 (23; 72)
Stock CPUE =	19.5 (24; 39)
PSD =	8 (5)

Figure 3. Comparison of the number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Hubbard Creek Reservoir, Texas, 2011, 2013, and 2015.

Blue Catfish



Effort =	15.0
Total CPUE =	2.4 (20; 36)
CPUE-12 =	1.9 (20; 29)
PSD =	55 (10)

Effort =	10.0
Total CPUE =	3.8 (22; 38)
CPUE-12 =	3.7 (24; 37)
PSD =	35 (12)

Effort =	20.0
Total CPUE =	3.1 (13; 62)
Stock CPUE =	3.0 (14; 59)
PSD =	49 (6)

Figure 4. Comparison of the number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Hubbard Creek Reservoir, Texas, 2008, 2012, and 2016. The vertical line denotes the 12-inch minimum length limit.

Channel Catfish

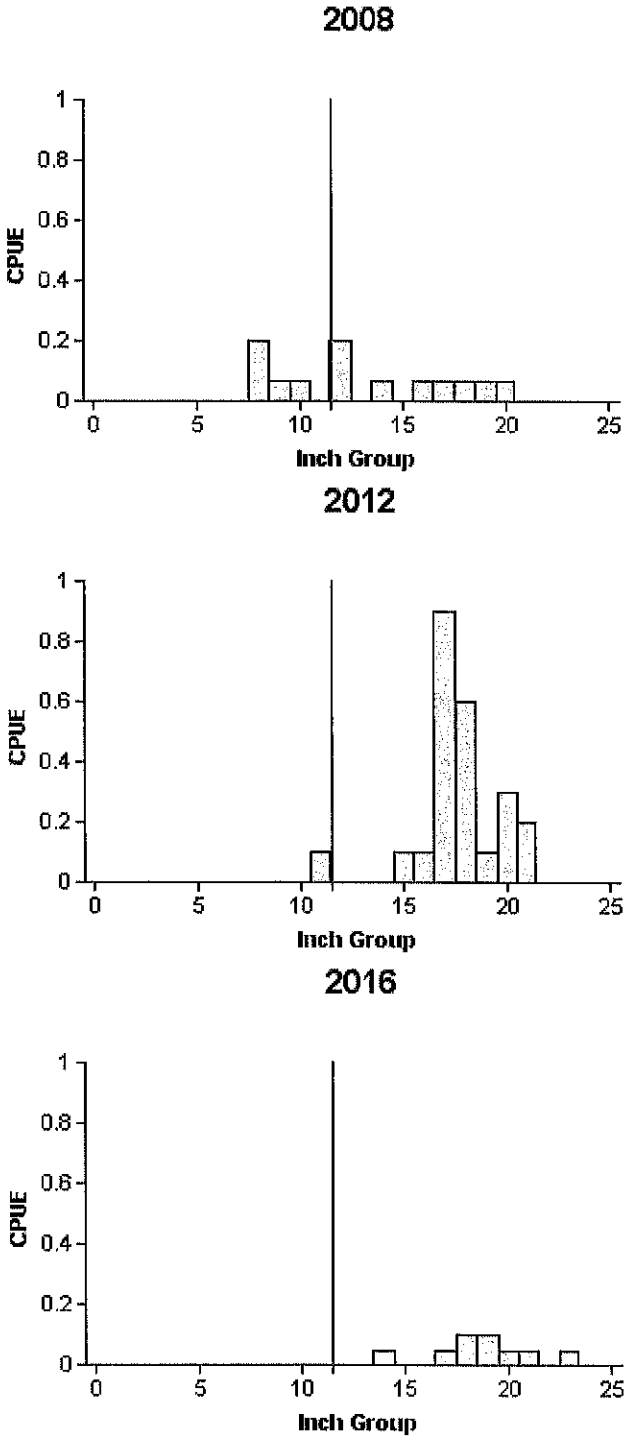
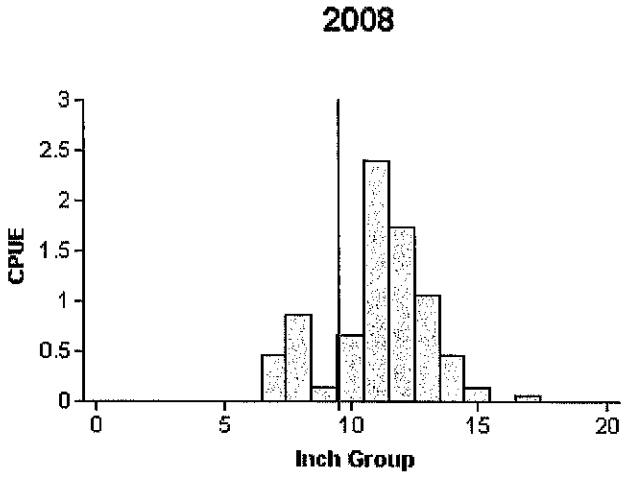
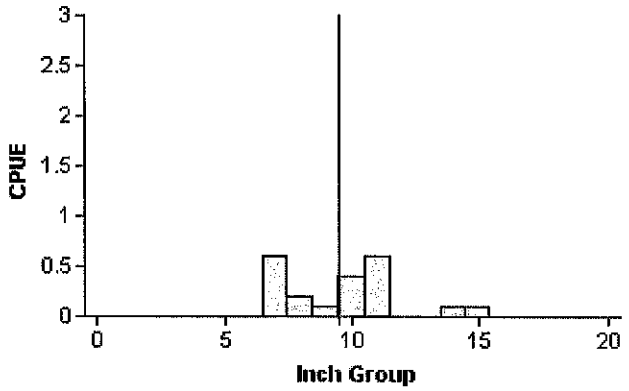


Figure 5. Comparison of the number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Hubbard Creek Reservoir, Texas, 2008, 2012, and 2016. The vertical line denotes the 12-inch minimum length limit.

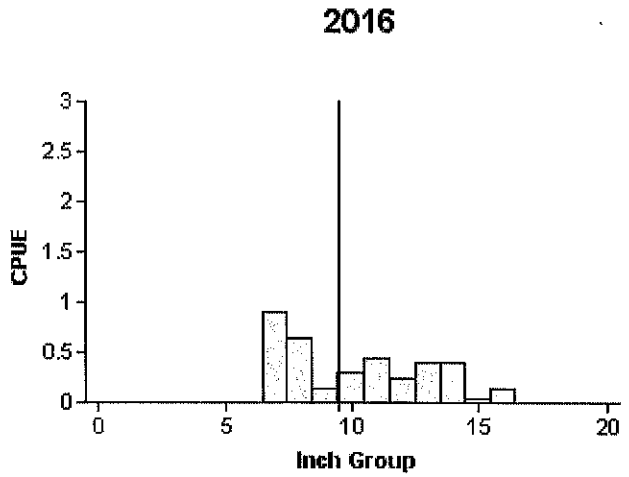
White Bass



Effort =	15.0
Total CPUE =	8.0 (28; 120)
Stock CPUE =	8.0 (28; 120)
CPUE-10 =	6.5 (28; 98)
PSD =	83 (7)



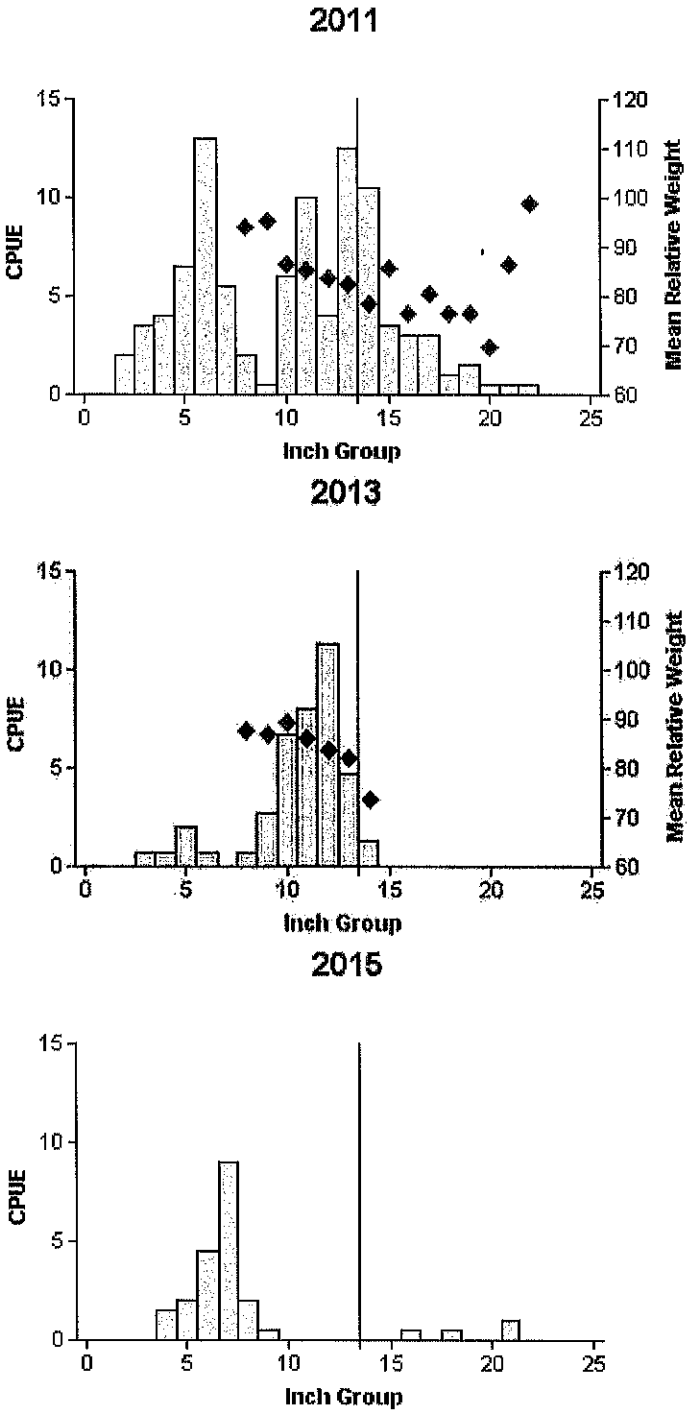
Effort =	10.0
Total CPUE =	2.1 (51; 21)
Stock CPUE =	2.1 (51; 21)
CPUE-10 =	1.2 (65; 12)
PSD =	62 (13)



Effort =	20.0
Total CPUE =	3.7 (35; 74)
Stock CPUE =	3.7 (35; 74)
CPUE-10 =	2.0 (47; 40)
PSD =	58 (8)

Figure 6. Comparison of the number of White Bass caught per net night (CPUE), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Hubbard Creek Reservoir, Texas, 2008, 2012, and 2016. The vertical line denotes the10-inch minimum length limit.

Largemouth Bass



Effort =	2.0
Total CPUE =	93.5 (21; 187)
Stock CPUE =	59.0 (20; 118)
CPUE-14 =	24.0 (26; 48)
PSD =	69 (5)

Effort =	1.5
Total CPUE =	39.3 (31; 59)
Stock CPUE =	35.3 (35; 53)
CPUE-14 =	1.3 (69; 2)
PSD =	49 (9)

Effort =	2.0
Total CPUE =	21.5 (29; 43)
Stock CPUE =	4.5 (39; 9)
CPUE-14 =	2.0 (59; 4)
PSD =	44 (19)

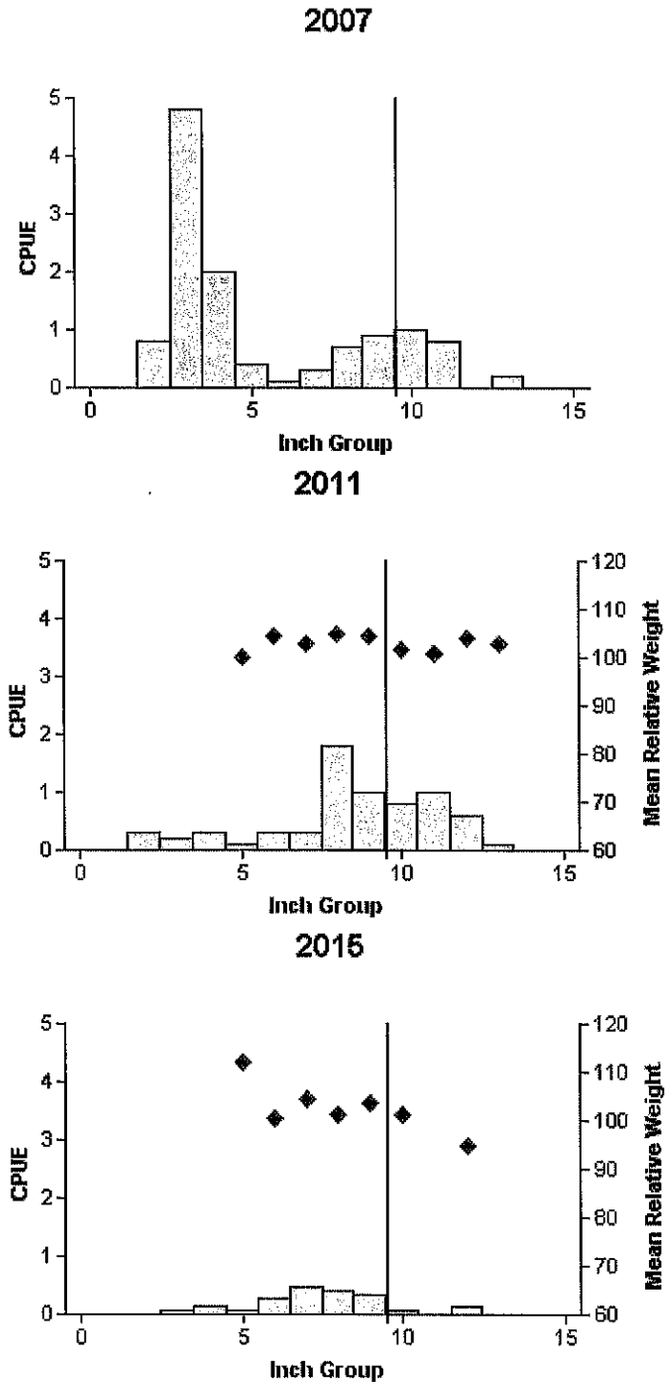
Figure 7. Comparison of the number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Hubbard Creek Reservoir, Texas, 2011, 2013, and 2015. No mean relative weights were determined in 2015. The vertical line denotes the 14-inch minimum length limit.

Largemouth Bass

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Hubbard Creek Reservoir, Texas, 1993, 1996, 1999, 2005, 2011, and 2015. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

		Number of fish				
Year	Sample size	FLMB	Intergrade	NLMB	% FLMB alleles	% FLMB
1993	40	1	25	14	30.6	2.5
1996	29	10	16	3	68.9	34.5
1999	30	4	26	0	59.2	13.3
2005	32	1	28	3	45.5	3.1
2011	40	2	37	1	54.4	5.0
2015	36	1	35	0	58.0	2.8

White Crappie



Effort =	10.0
Total CPUE =	12.0 (30; 120)
Stock CPUE =	4.4 (32; 44)
CPUE-10 =	2.0 (30; 20)
PSD =	82 (6)

Effort =	10.0
Total CPUE =	6.8 (29; 68)
Stock CPUE =	6.0 (25; 60)
CPUE-10 =	2.5 (38; 25)
PSD =	88 (5)

Effort =	15.0
Total CPUE =	1.9 (32; 29)
Stock CPUE =	1.7 (33; 26)
CPUE-10 =	0.2 (53; 3)
PSD =	54 (13)

Figure 8. Comparison of the number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Hubbard Creek Reservoir, Texas, 2007, 2011, and 2015. No mean relative weights were determined in 2007. The vertical line denotes the 10-inch minimum length limit.

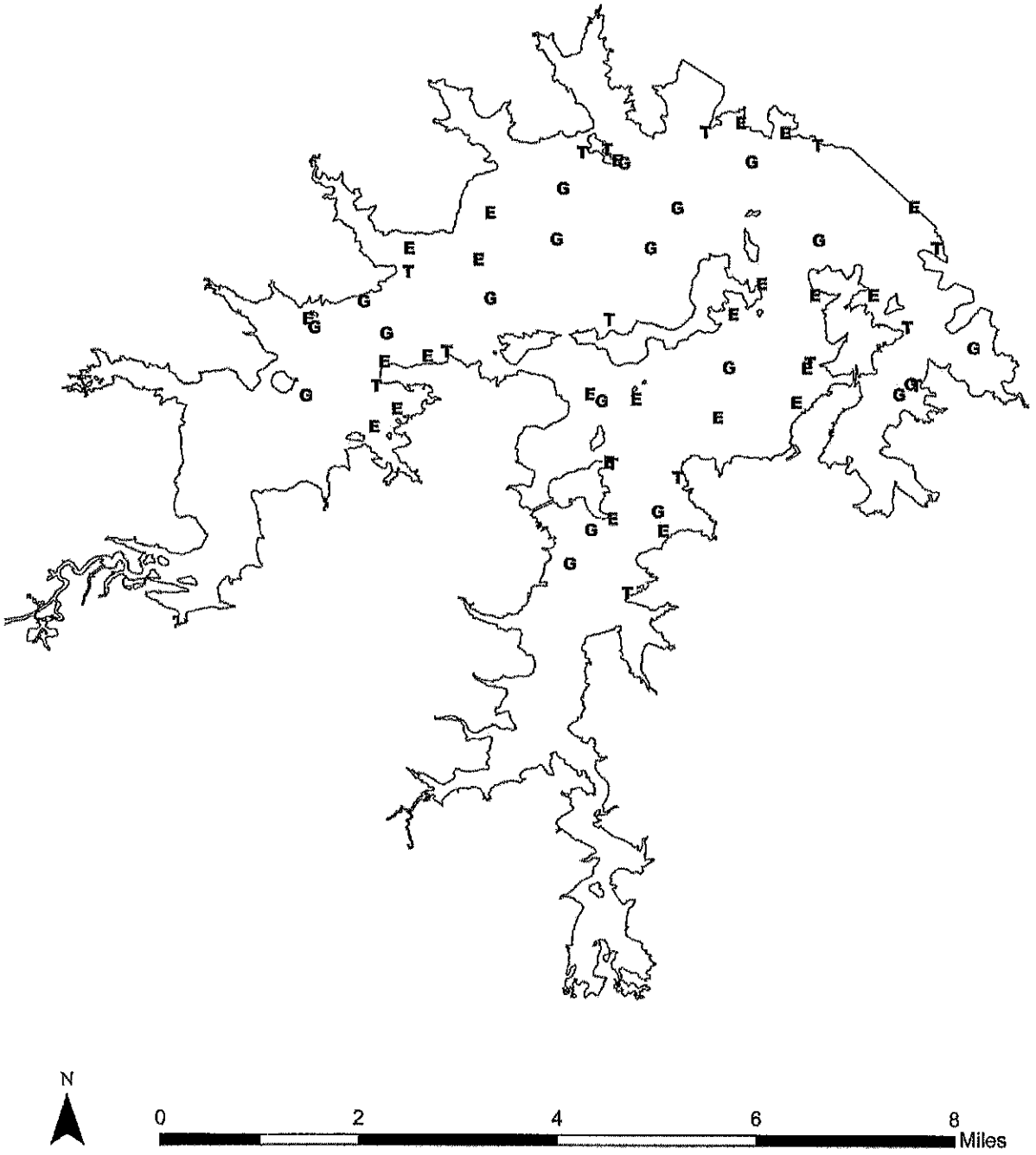
APPENDIX A

Number (N) and catch rate (CPUE) and associated relative standard error (RSE) of all target species collected from standard gear types from Hubbard Creek Reservoir, Texas, 2015-2016. Sampling effort was 2.0 hours for electrofishing, 20 net nights for gill netting, and 15 net nights for trap netting.

Species	Electrofishing		Gill Netting		Trap Netting	
	N	CPUE/RSE	N	CPUE/RSE	N	CPUE/RSE
Gizzard Shad	240	120.0/23				
Common Carp[1]	5	2.5/50				
Inland Silverside	2	1.0/69				
River Carpsucker[1]	23	11.5/41				
Blacktail Shiner	1	0.5/100				
Smallmouth Buffalo[1]	3	1.5/100				
Blue Catfish			62	3.1/13		
Channel Catfish	1	0.5/100	10	0.5/31		
Flathead Catfish			5	0.3/49		
White Bass	249	124.5/38	74	3.7/35		
Green Sunfish	6	3.0/43				
Warmouth	6	3.0/50				
Orangespotted Sunfish	3	1.5/55				
Bluegill	72	36.0/23				
Longear Sunfish	79	39.5/40				
Redear Sunfish	1	0.5/100				
Largemouth Bass	43	21.5/29				
White Crappie	1	0.5/100			29	1.9/32
Logperch	1	0.5/100				
Freshwater Drum	6	3.0/36				

[1]Fish sampled ≤ 6 inches TL.

APPENDIX B



Location of sampling sites, Hubbard Creek Reservoir, Texas, 2015-2016. Electrofishing (E), gill netting (G), and trap netting (T) stations are displayed. Reservoir outline at conservation pool is displayed by a gray line. Throughout the sampling period, the reservoir was approximately 15.7 feet below conservation pool on average at time of sampling.

D LHSES FINE-MESH SCREEN EVALUATION

ALDEN

Solving flow problems since 1894

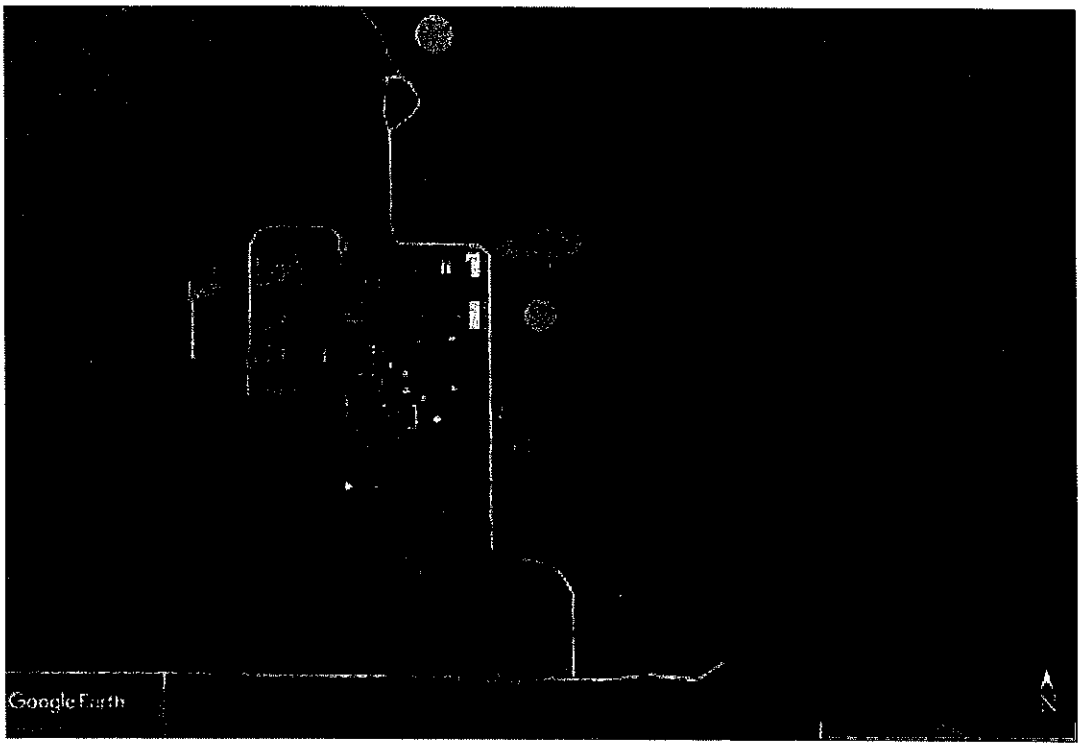
Appraisal Level Design and Costs Estimate for Fine-mesh Ristroph and Cylindrical Wedgewire Screens to meet 316(b) for the Lake Hubbard Steam Electric Station

DRAFT

Prepared for:

Luminant

March 2019



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1 INTRODUCTION

The Texas Commission on Environmental Quality (TCEQ) is in agreement with Luminant that the Lake Hubbard Steam Electric Station (LHSES) withdraws from a cooling reservoir and has a closed-cycle recirculating system. To make a best technology available (BTA) determination on entrainment, a brief description and appraisal level cost estimate of options to further reduce entrainment were developed in this study. Two fine-mesh intake technologies were evaluated; fine-mesh traveling water screens (TWS) with fish friendly features, and narrow-slot cylindrical wedgewire screens. Both 0.5 mm and 2.0 mm openings were evaluated for each technology.

2 CWIS DESCRIPTION

LHSES is located on the western shoreline of Lake Ray Hubbard near Sunnyvale, Texas. Lake Ray Hubbard is a man-made reservoir created in 1968. The reservoir was built primarily as a water supply for the city of Dallas, but also as a source water body of the Lake Hubbard SES, and is managed by the Dallas Water Utilities. The reservoir has a surface area of approximately 22,745 acres and a total storage capacity of about 490,000 acre-ft. Water levels in the reservoir range from a conservation pool elevation of 435.5 ft to a high water at elevation 440.5 ft. All elevations are based on National Geodetic Vertical Datum of 1929 (NGVD29).

LHSES is a two unit natural gas fired facility, Unit 1 generates 393 MW and Unit 2 generates 528 MW. Both units utilize once-through cooling water systems. LHSES has one cooling water intake structure (CWIS), located at the end of a small intake canal on the western shoreline of the reservoir. The intake canal entrance has an invert at El. 399.0 ft and slopes down to El. 391.0 ft at the face of the CWIS.

The CWIS for Units 1 and 2 is about 91 ft wide with an invert at El. 391.0 ft. The CWIS has five bays. Two bays are for Unit 1 and three bays are for Unit 2. Each of the five intake bays are equipped with a traveling water screen, a trash rack, a coarse-mesh fixed screen, and circulating water pump. Trash racks are located at the front of the intake and have 3/8 in. by 3 in. bars spaced 2.5 in. on center. Traveling water screens are located about 12 ft downstream of the trash racks. Each screen is 10 ft wide with a 1/4 in square mesh. The screens are rotated at 11.3 ft/min. Trash and debris are removed from the screens using a front spraywash system. Coarse-mesh fixed screens are located about 10 ft downstream of the traveling water screens and are 11.2 ft wide with a 3/8 square mesh. Circulating water pumps are located about 14 ft downstream of the coarse-mesh fixed screens.

The two circulating water pumps used for Unit 1 have a rated capacity of 206 cfs (92,500 gpm). The three circulating water pumps used for Unit 2 have a rated capacity of 245 cfs (101,000 gpm). When all five circulating water pumps are operating, the circulating water flow to the facility is 1,147 cfs (488,000 gpm). The total flow through the CWIS increases to 1,346 cfs (604,200 gpm) after service and screen wash water is included.

3 CONCEPTUAL DESIGN TO RETROFIT THE EXISTING INTAKE WITH FINE-MESH MODIFIED TRAVELING WATER SCREENS AND A FISH RETURN SYSTEM

Fine-mesh TWS modified with fish protection features (also known as modified-Ristroph or Ristroph-type screens) are one of the most commonly used technologies for reducing entrainment mortality at CWIS. The screens include all of the BTA features identified in the §125.92(s) for coarse-mesh screens including fish-lifting buckets, low-pressure spray washes, and continuous rotation. A drawing showing some of the fish protection features of a typical Ristroph-type screen is shown on Figure 3-1. The use of fine-mesh with modified traveling water screens does not impact impingement survival of larger organisms and the screens can be used under § 125.94(c)(5) for best technology available (BTA) requirements for reducing impingement mortality.

Several types of fine-mesh TWS with fish protection features are available. They include through-flow traveling screens (similar to the existing screens); dual-flow screens (like standard screens only rotated 90 degrees to the flow); and rotary-disk screens (both the ascending and descending sides of the screen face upstream). All of these TWS options are compatible with 0.5-mm and 2.0-mm fine-mesh. The feasibility and cost differential of installing fine-mesh fish modified traveling screens with any of these available screen types or either mesh size is indistinguishable at this level of design and costing.

Fine-mesh TWS can either be installed in the existing intakes or in expanded intakes to lower the approach and through-screen velocity. At The conservation pool elevation of 435.5 ft the velocity approaching the Unit 1 screens is approximately 0.6 fps. Under the same water conditions the velocity approaching the Unit 2 screens was calculated to be approximately 0.6 fps. The screen approach velocities at the lowest recorded water elevation in the reservoir of elevation 424.93 ft are estimated to be 0.7 fps and 0.8 fps for Unit 1 and Unit 2 respectively.

Screen approach velocities up to 1.5 ft/sec have shown no or minor effect on post-collection survival of the larger (> 12 mm) larvae tested during an EPRI sponsored fine-mesh modified TWS laboratory study (EPRI 2010). This is consistent with the findings of EPRI sponsored coarse-mesh modified TWS laboratory studies (EPRI 2006; Black 2007) that reported approach velocities did not appear to affect post-impingement survival of juvenile and adult fish, ≥50 mm, over a range of 1-3 ft/sec tested. Post-collection survival of smaller (< 12 mm) entrainable fish was generally poor (~30%), regardless of the screen approach velocity. Therefore, it is our best professional judgement (BPJ) that fine-mesh modified traveling water screens installed in the existing screen bays would be technically feasible at LHSES.

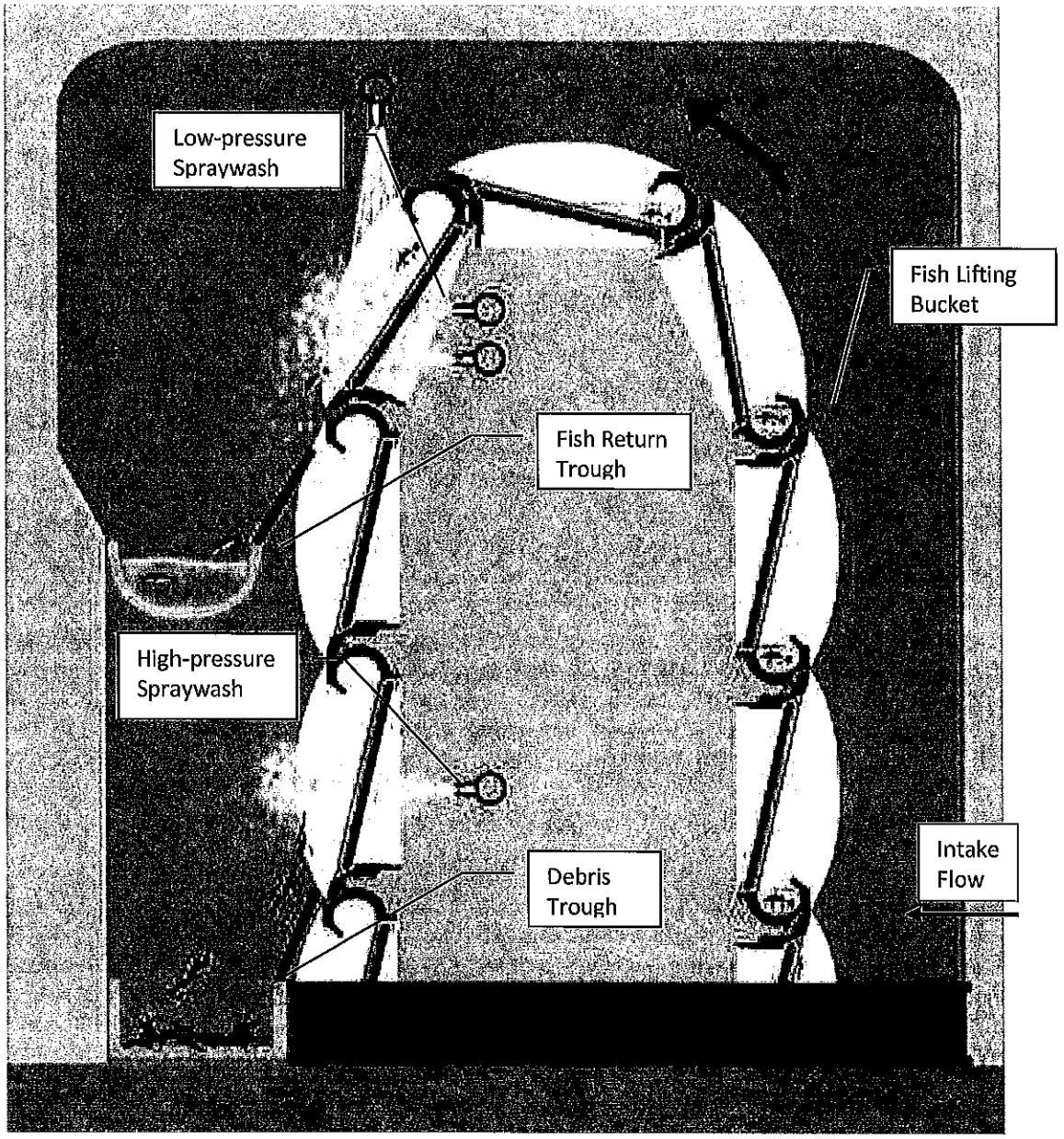

Figure 3-1: Typical Fish-Friendly Features of a Modified Traveling Water Screen

3.1 Design and Operation

The new fine-mesh modified TWS would be installed in the existing screen bays, replacing the existing TWS. Each screen basket would incorporate a fish bucket to hold collected organisms in about 2 inches of water while they are lifted to the fish recovery system. A low-pressure spray wash would be used to gently remove the fish from the fish holding buckets into a fish sluice and a conventional high-pressure wash would then remove remaining debris into a debris sluice. High pressure spray wash water for the existing screens is currently withdrawn from the warm water discharge. The existing spraywash system is not expected to be sufficient to meet the spraywash needs of the new screens and a new, larger spraywash pump is assumed for each unit.

Fish and debris removed by the low-pressure spray washes would flow into a fish trough located above the debris trough. The fish troughs from all five screens would combine with the debris troughs downstream of the last screen. The combined fish and debris trough would flow south and east for approximately 1,800 ft , as shown in Figure 3-2. This discharge location was selected because it is away from the intake canal minimizing potential re-impingement.

Operation and maintenance (O&M) activities associated with the new screens are similar to those required for the existing TWS. The level of effort necessary would increase as a result of increased operation of the screens. The screens would be rotated and cleaned continuously whenever a unit's circulating water pumps are operating as required by the Rule for modified traveling screens to reduce impingement duration of impingeable and entrainable life stages. The screens could be rotated 1.5 turns per day when the units are not operating. Fine-mesh screens use small diameter wires that are more prone to damage from debris and fouled spray wash nozzles and require additional effort to inspect and maintain including the replacement of approximately 20% of the fine-mesh material annually. Repairs and replacement of other screen components including major overhauls of the screens is estimated at 10% of the capital cost of the new screens per year. The fish return line would be inspected and cleaned daily to prevent any debris plugging and to remove bio-growth.

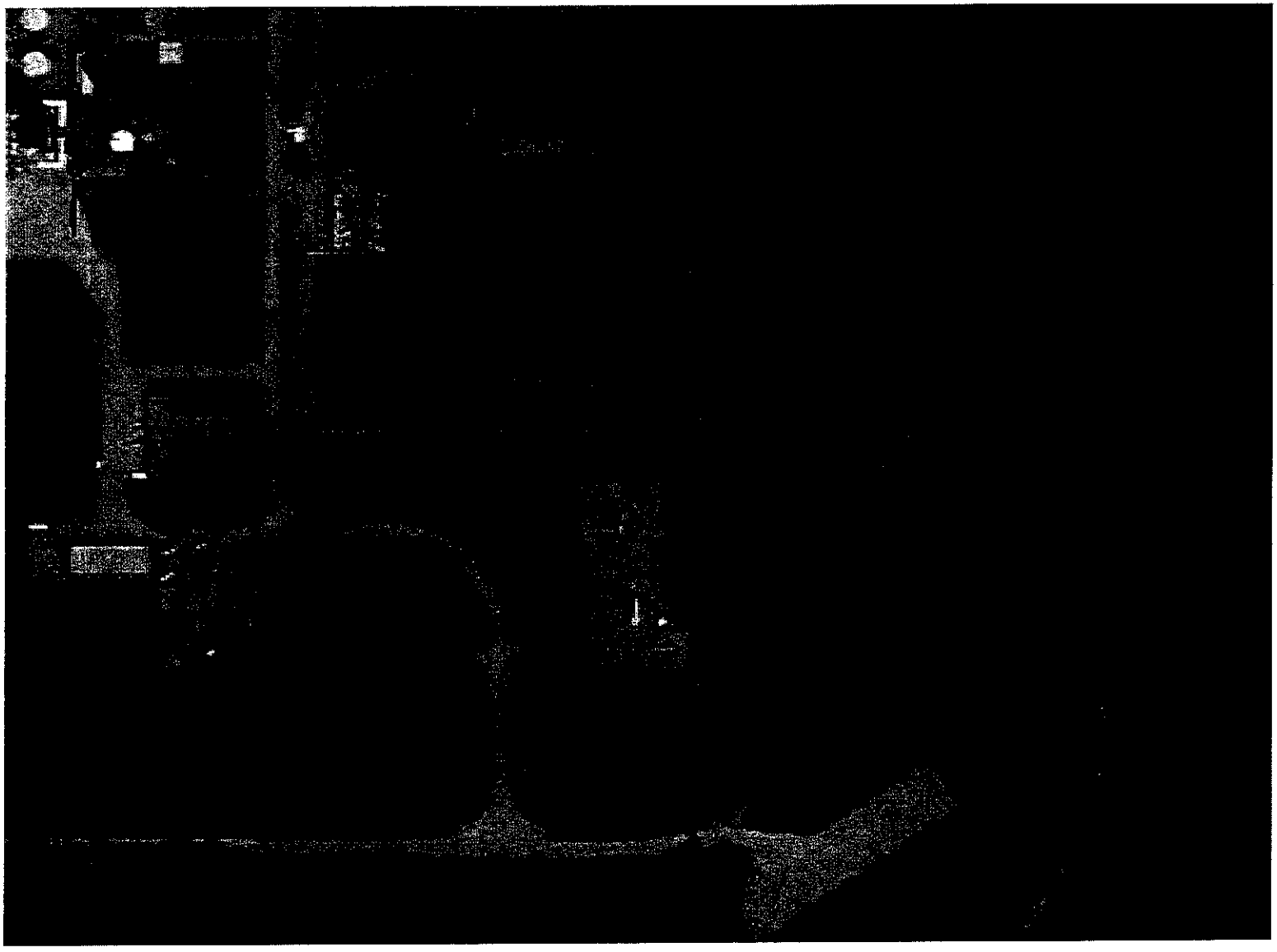

Figure 3-2: Conceptual Design for Fish Return – Plan

3.2 Uncertainty and Additional Studies

Debris Handling and Clogging Study – There is limited data on the ability to maintain fine-mesh screens in Texas cooling reservoirs. A pilot study should be conducted to determine if fine-mesh screens can be installed as a result of debris and biofouling conditions in Lake Ray Hubbard. This study, including the costs to modify an existing screen with fine-mesh material, is expected to cost approximately $150,000 for a 1 year fine-mesh deployment.

Study to Evaluate Screen Impact on Cooling Water Pump Performance – Head loss across the traveling water screens would increase due to the reduced open area associated with the fine-mesh screens. The increase in head loss across the fine-mesh screens would vary based on the water levels and selected mesh size. While Alden does not expect any pump maintenance or operational issues, a pump intake model should be conducted prior to adding fine-mesh screens to the CWIS. This model would investigate potential adverse impacts to the pump performance. The study is expected to cost approximately $50,000 and is included in the overall cost estimate for this option.

Fish Return Discharge Studies – The fish return design presented in this evaluation is conceptual in nature. A detailed engineering analysis including a hydraulic study of the return over the range of expected flows would be needed to refine the design of the fish return. These studies are expected to cost approximately $70,000 and are included in the overall cost for this option.

4 CONCEPTUAL DESIGN OF NARROW–SLOT CYLINDRICAL WEDGEWIRE SCREENS

Narrow-slot wedgewire screens are exclusion devices that act as a passive barrier to reduce impingement of juvenile and adult fish and the entrainment of eggs and larval fish into a CWIS. Two narrow-slot sizes, 0.5 mm and 2.0 mm were evaluated in this study. Wedgewire screen designs developed in this assessment use an average through-slot velocity of 0.43 ft/sec. This low design through-screen velocity, (e.g. ≤0.5 ft/sec), allows cylindrical wedgewire screens to automatically meet Compliance Alternative 2 at § 125.94(c)(2) of the Rule for impingement BTA.

The efficacy of wedgewire screens with entrainable sized organisms is dictated primarily by the slot (opening) size and the sizes of the organisms present near the screens. Fish behavior near the screens also plays a role in the overall effectiveness of the screens and larvae longer than about 6 to 8 mm have been shown to possess sufficient swimming capabilities to completely avoid entrainment despite being able to physically fit through the slot openings (Otto et al 1981). In addition, local flow conditions that include the through-slot velocity and ambient currents (also referred to as the channel or approach velocity) can affect screen performance. Entrainment has been positively correlated with through-slot velocity and inversely related to ambient velocity (Hanson et al. 1978; Heuer and Tomljanovich 1978; EPRI 2003). Too be most effective, a combination of low through-slot velocity and ambient cross-currents in the water body should be present to carry debris and organisms with limited motility past the screens. Overtime, this will lead to an accumulation of debris around the screens that will need to be manually removed.

Ambient currents within a cooling reservoir, such as Lake Ray Hubbard, are expected to be primarily a result of the circulating water flow. Wind and thermal differences are also expected to affect localized currents. In the absence of ambient currents to move eggs and larvae past the screens, the biological effectiveness of narrow-slot wedgewire screens would be lower than what would be expected in a riverine or other environment with greater ambient currents. The lack of ambient currents would also limit the effectiveness of any cleaning system because there would be no currents to transport debris away from the screens.

4.1 Design and Operation

Both potential wedgewire screen arrays at LHSES were designed with 7-ft diameter Tee-shaped screens, with an average through-slot velocity of 0.43 ft/sec. Each screen includes two 7-ft long screening sections on either end of a center non-screening section with an approximate overall length of 23 ft, as shown on Figure 4-1.

Both options would use screens mounted to intake pipes connected to a bulkhead wall constructed across the face of the existing intake canal. Automated gates built into the bulkhead wall would act as emergency bypass gates in the event the wedgewire screens cannot be maintained in a clean condition. The traveling water screens would remain in place and operational to screen the intake flow if the wedgewire screens need to be bypassed.

The difference between the two slot sizes is the number of screens and the number and size of the header pipes. The total number of screens and header pipe sizing information for both slot sizes is provided in Table 4-1.

The header pipes would be aligned and anchored to the reservoir bottom using large concrete anchors. These header pipes would extend out into the main body of the reservoir to take advantage of any potential ambient currents within the reservoir. An automatic cleaning system, either brush cleaned or air-backwash would be used to clean the screens. A new extended boat barrier would be modified to prevent damage to either the screens or boats using the reservoir. The layout of the 0.5 mm slot option is provided on Figure 4-2 and the 2.0 mm slot option on Figure 4-3.

The new screens would be equipped with an automated system to remove any debris and biofouling from the screen face. Two automatic cleaning systems are available; an air-backwash and a brush cleaning system. The air-backwash system was chosen for this evaluation, however a pilot study is recommended to select the most appropriate cleaning system and cleaning frequency for LHSES. Alden anticipates that screens with 0.5 mm slot openings would require more frequent cleaning than screens 2.0 mm slot openings. The screens would be cleaned regardless of station operations to remove debris that settles on the screens and reduce biofouling. In addition to regular cleanings, bi-annual diver inspections to remove large debris and identify damage or sediment buildup around the screens would also be necessary. The emergency bypass gates, built into the bulkhead wall, would be tested at least once a month and the remaining traveling water screens rotated for approximately 10 minutes per day to ensure they remain operational. Visual inspections of the screen deployment area and cleaning control systems should be conducted daily. Replacing wear items and repairing any damaged screens is estimated to cost 5% of the capital cost of the new screens and cleaning system annually. Maintenance requirements for the existing circulating water pumps would not change.

Table 4-1: Differences between the 0.5 mm slot and 2.0 mm slot 72 inch Diameter Wedgewire Tee-screen Options for LGSES

Slot-size	Total Number of Screens	Number of Header Pipes	Header Pipe Diameter (ft)
0.5 mm	48	8	7.5
2.0 mm	20	5	8

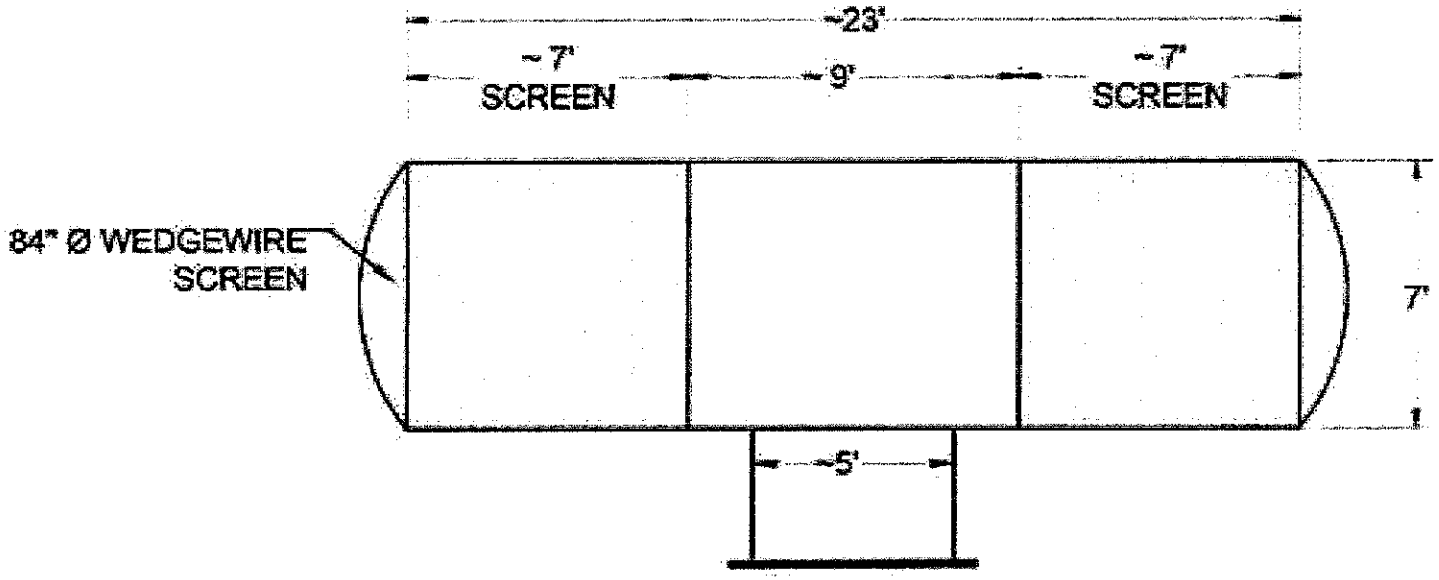

Figure 4-1: Typical 7.0-ft Diameter Narrow-slot Wedgewire Tee Screen

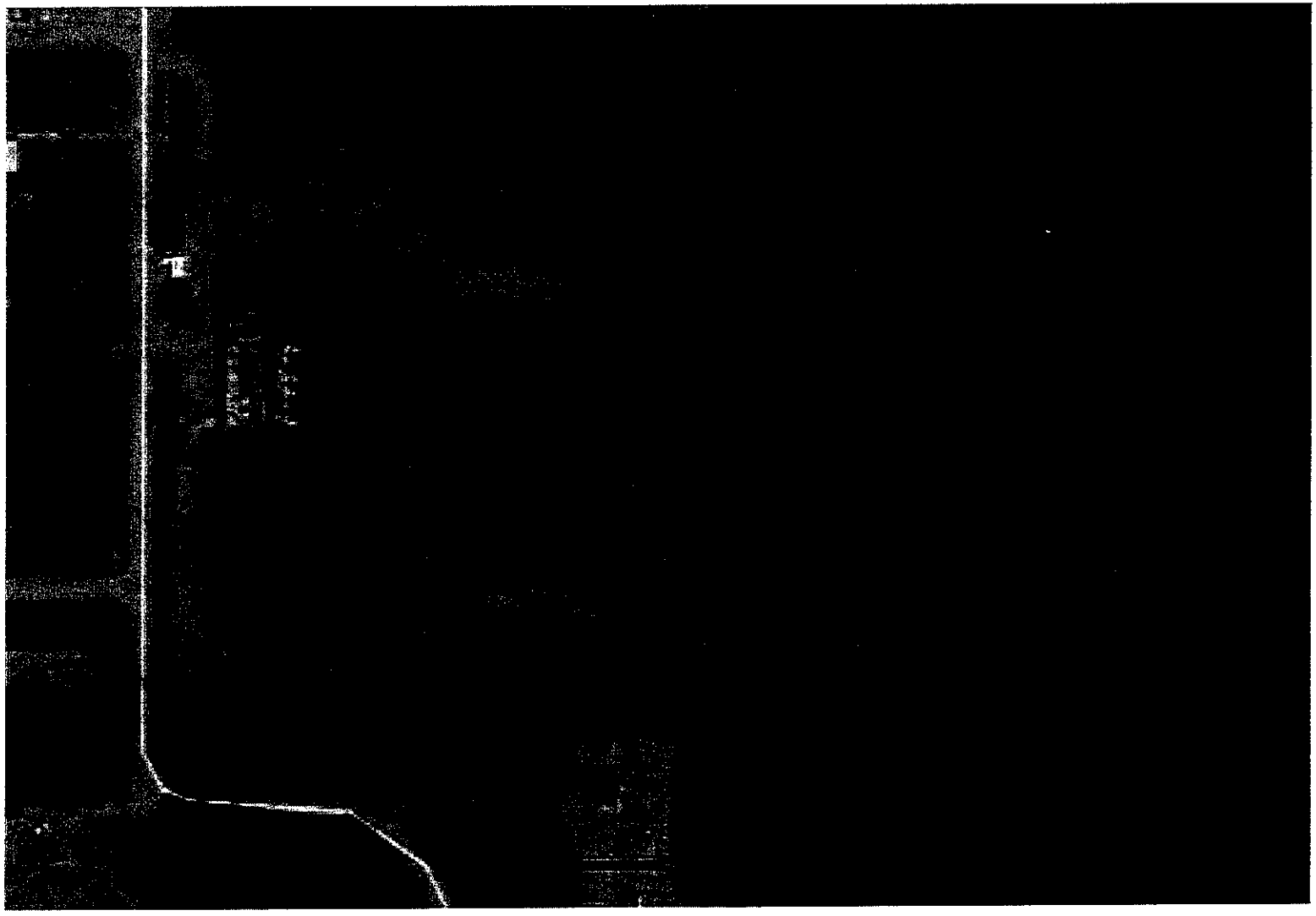

Figure 4-2: Conceptual 0.5 mm Slot Wedgewire Screen Design – Plan

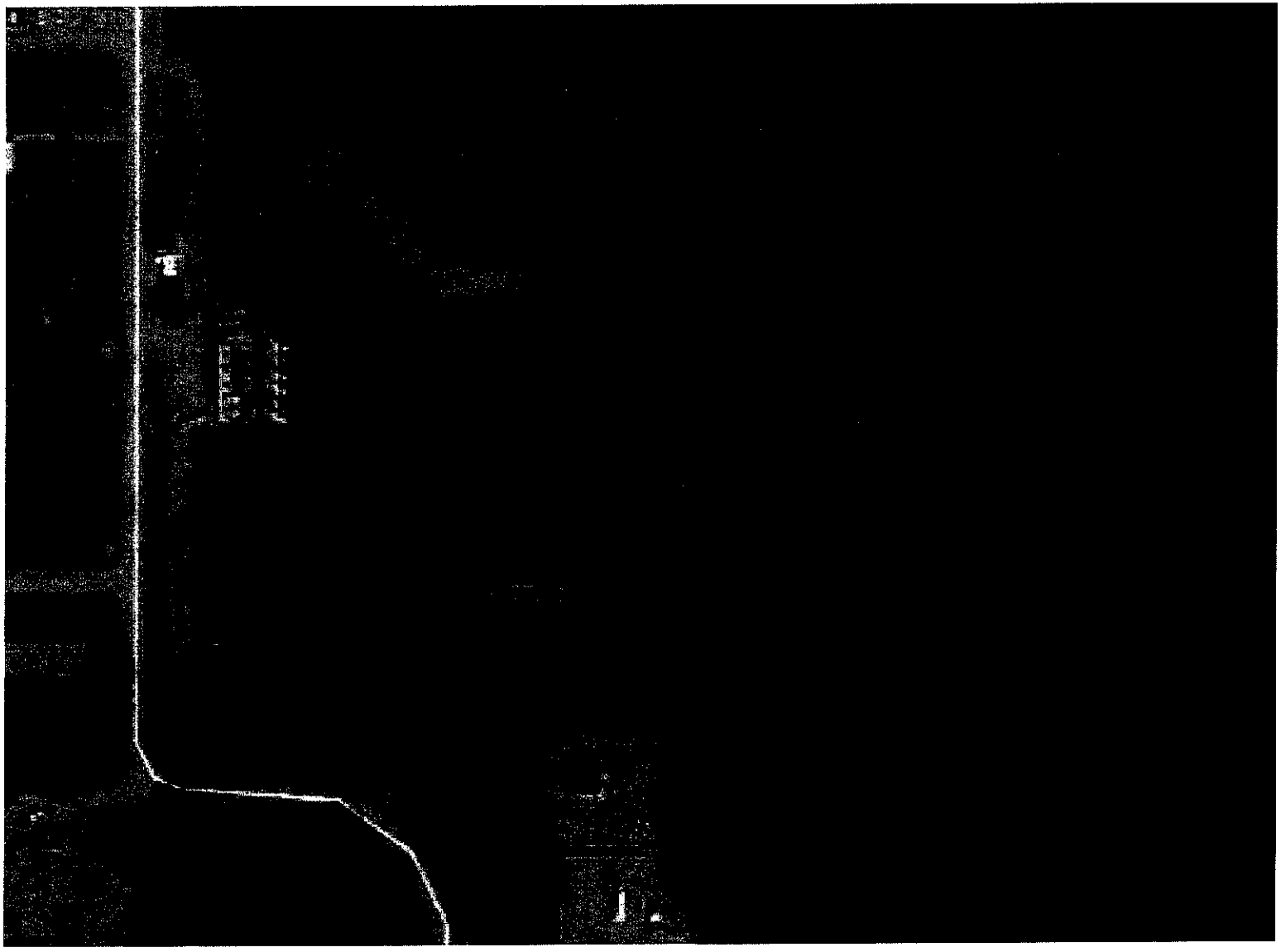

Figure 4-3: Conceptual 2.0 mm Slot Wedgewire Screen Design – Plan

4.2 Uncertainty and Required Additional Studies

Submerged cylindrical wedgewire screens are commonly used to screen riverine intakes where there is a sweeping current past the screens or deep cold water lakes with limited aquatic vegetation. Alden is aware of only one generating facility that uses narrow-slot cylindrical wedgewire screens with once-through cooling. The facility uses brush cleaned screens with 0.75 mm slots in a deep water lake. As a result, prior to making a BTA determination for any of the wedgewire screen options at LHSES, it will be necessary to conduct studies to confirm the operational feasibility of these screens.

Biofouling and Debris Control Studies - A pilot study to approximate the rate of debris loading and biofouling at the proposed deployment location will be required to ensure that the screens can be maintained under the debris loading and biofouling conditions in Lake Ray Hubbard. The results of this study will confirm the technical feasibility of the proposed screens and increase the accuracy of the O&M cost estimate. This study is expected to cost an estimated $250,000 and has been included in the total project costs.

Study to Evaluate Screen Impact on Cooling Water Pump Performance – Both cylindrical wedgewire configurations will result in approximately a 2 ft reduction in water level at the pumps with clean screens. However, this may adversely affect pump performance. This is especially true if debris plugging or biofouling becomes an issue. A hydraulic model study (physical or numeric model) is required to investigate potential adverse impacts to the pump performance. The study will also be used to verify and optimize the flow distribution through the screens and determine cleaning frequency. This study is expected to cost approximately $50,000 and is included in the overall cost estimate for this option.

Navigation Impacts – Both wedgewire options require the existing boat exclusion zone to be extended out into the reservoir. For the 0.5 mm slot option, the new barrier would extend out approximately 220 ft into the late. The reservoir in this area is approximately 2 miles wide. As a result, the screens are expected to have limited impacts to navigation within the reservoir. A study would be needed to quantify any hazards or navigational impacts as a result of the wedgewire screen array if either option is to be considered further. Costs for this study are not included in the overall costs.

5 ENGINEERING COST ESTIMATES

Costs based on the conceptual designs, were estimated using Alden's cost database. These costs were adjusted for identifiable differences in project sizes and operations. Due to their generalized nature, these appraisal-level order of magnitude cost estimates are intended to identify the relative cost differences between selected alternatives and provide budgetary cost estimates for fine-mesh screen options at LHSES. These costs are consistent an Association for the Advancement of Cost Engineering (AACE) Class 5 estimates (AACE 2005). The accuracy for order-of-magnitude costs is typically -30% to +50%.

Pre-construction permitting and study costs are also included when necessary. Permitting costs have been taken as 2% of the materials and labor cost for each alternative. Costs for additional laboratory or field studies that may be required include; hydraulic modelling studies, and biological or engineering evaluations of prototype fish protection systems. The costs associated with these additional studies were estimated using historical study cost estimates developed by Alden for other projects and are considered indirect costs.

Ongoing costs to operate the fine-mesh screens are based on Alden's experience estimating detailed O&M adjusted for identifiable differences in project sizes and operations. Labor costs were assumed at $40 per man-hour. The power cost to operate each technology was assumed to be $36.08/MWh. This value represents the average cost to operate and maintain an investor owned fossil plant in 2016 (EIA 2017). Costs for regular repairs and major overhauls of the fine-mesh screens are included as part of the overall O&M estimate.

Facility compliance costs were developed for the fine-mesh TWS and narrow-slot wedgewire screen options. The facility compliance costs are the costs that Luminant would incur at LHSES for each of the alternatives. These costs are presented as the net present value (NPV) and equivalent annual costs (EAC), based on assumed remaining life expectancy of 30 years (2018-2047). NPV is provided to convert all the present and future costs to a base year, assumed to be 2018. This was done to estimate the present cost of each alternative over its lifespan. EAC is the annual costs of owning, operating and maintaining each option over the life of the technology. This cost can be used as part of a benefits cost analysis by comparing them to the expected annual benefits provided by each alternative.

The costs used for the NPV and EAC analysis are based on incremental changes from current CWIS design and operations. Constant dollars, as recommended by EPA for developing cost estimates during feasibility studies (EPA 2000), were used for the present value analysis. Constant dollars assume the cost of goods and services remain the same over time and are not affected by inflation or deflation. These constant dollars were then adjusted with discount rates of 3% and 7% to account for the time value of the money. The use of these discount rates is consistent with the social discount rates required as part of the social cost analysis required by EPA under the § 316(b) Rule. Taxes and depreciation were not considered in this analysis.

The costs for the three fine-mesh screen options evaluated at LHSES are summarized in Table 5-1. The compliance costs are presented in Table 5-2

Table 5-1: Order of Magnitude Costs for Fine-mesh Screens at LHSES

Alternative	Capital Costs (2018 $)	Permitting and Pre-construction Study Costs (2018 $)	Annual O&M (2018 $)
Fine-Mesh Ristroph Screens in Existing Intake	$10,870,000	$394,000	$497,000
Narrow-slot Wedgewire Screens with 0.5 mm Slots	$33,013,000	$677,000	$768,000
Narrow-slot Wedgewire Screens with 2.0 mm Slots	$16,421,000	$488,000	$309,000

Table 5-2: Incremental NPV and Annualized Compliance Cost Estimate for Fine-mesh Screens at LHSES

Technology	Fine-Mesh Ristroph Screens in Existing Intake	Narrow-slot Wedgewire Screens with 0.5 mm Slots	Narrow-slot Wedgewire Screens with 2.0 mm Slots
Net Present Value (2018 $) (7% Discount rate)[1,2]	$13,552,000	$37,508,000	$18,034,000
Net Present Value (2018 $) (3% Discount rate)[1,2]	$16,716,000	$45,042,000	$21,290,000
Equivalent Annual Cost (2018 $) (7% Discount rate)[1,2]	$1,092,000	$3,023,000	$1,453,000
Equivalent Annual Cost (2018 $) (3% Discount rate)[1,2]	$1,347,000	$3,630,000	$1,716,000

1. Incremental costs are the difference in costs from current traveling water screen operations.
2. Costs assume a remaining life expectancy of 30 years (2018-2047).

6 REFERENCES

Association for the Advancement of Cost Engineering (AACE). 2005. AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries, TCM Framework: 7.3 – Cost Estimating and Budgeting. February 2, 2005.

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Electric Power Research Institute (EPRI). 2003. Laboratory Evaluation of Wedge Wire Screens for Protecting Early Life Stages of Fish at Cooling Water Intakes. EPRI 1005339.

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Heuer, J. H. and D. A. Tomljanovich. 1978. A Study on the Protection of Fish Larvae at Water Intakes Using Wedge-Wire Screening. TVA Technical Note B26.

Otto, R. G., T. I. Hiebert and V. R. Kranz. 1981. The Effectiveness of a Remote Profile-Wire Screen Intake Module in Reducing the Entrainment of Fish Eggs and Larvae. In: Proceedings of the Workshop on Advanced Intake Technology, San Diego, CA, April 1981. P. B. Dorn and J. T. Larson (Eds.)

U.S. Energy Information Administration (EIA). 2017. Electric Power Annual 2016. December 7,2017. Available at: https://www.eia.gov/electricity/annual/ Accessed April 2, 2018.

U.S. Environmental Protection Agency (EPA). 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. Report Number EPA 540-R-00-002 OSWER 9355.0-75. July 2000. U.S. Army Corps of Engineers, Omaha Nebraska. U.S. EPA ,Washington, DC.

Attachment M

Design and Engineering Calculations of CWIS

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

40 CFR 122.21 IMPACTED BY 316(b) of Clean Water Act
Lake Hubbard Steam Electric Station
Cooling Water Intake

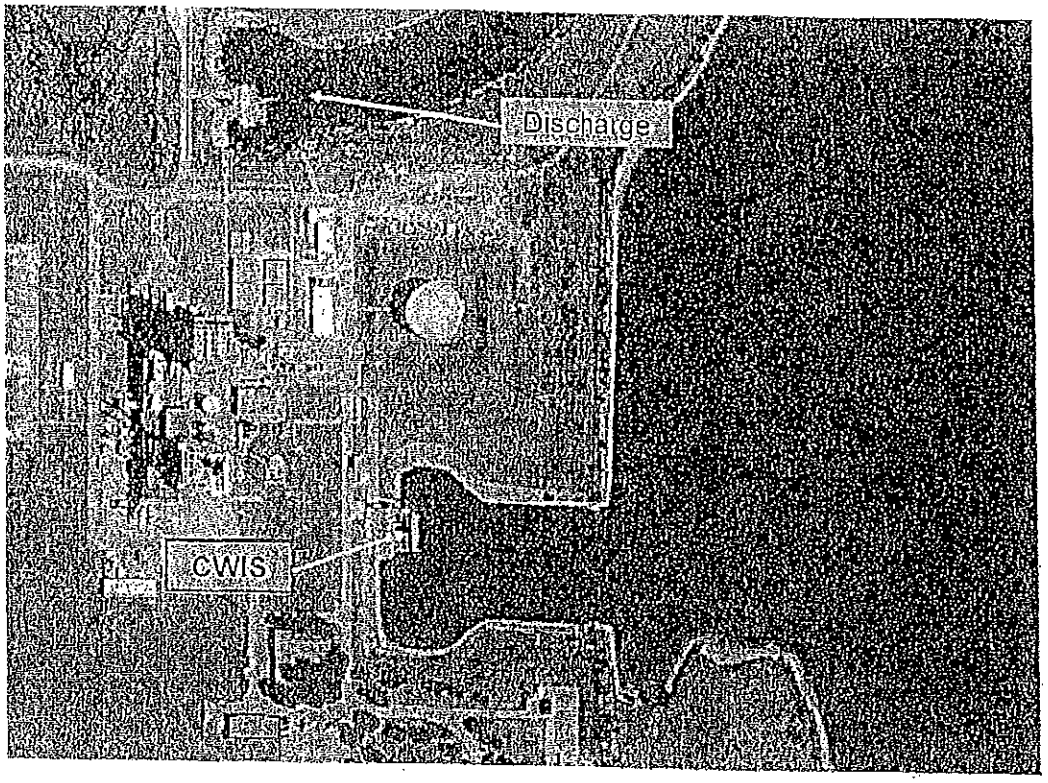
EPA signed into regulation new requirements for existing electric power generating facilities for compliance with Section 316(b) of the Clean Water Act on July 9, 2004. These regulations became effective on September 7, 2004 and are based on numeric performance standards. The Rule at 40 CFR 125 impacts 40 CFR 122.21 (Application for a permit) by requiring existing facilities defined in Part 125 to submit for review the following information:

(1) A narrative description of the operation of the cooling water system, its relationship to cooling water intake structures, the proportion of the design intake flow that is used in the system, the number of days of the year the cooling water system is in operation and seasonal changes in the operation of the system, if applicable;

Lake Hubbard station is located on Lake Hubbard, near Sunnyvale, Texas. The following figure provides an aerial photograph showing Lake Hubbard's intake on the reservoir. Lake Hubbard has a normal water level of El. 435.5 ft, a high water level of El. 440.5 ft, and a design low water level of El. 405.0 ft. Lake Hubbard has a total surface area of about 22,745 acres and a total storage capacity of about 490,000 acre-ft. There are two units that use once-through cooling. Unit 1 generates 393 MW and Unit 2 generates 528 MW. Unit 1 has two intake bays and Unit 2 has three intake bays. Each bay has a traveling water screen, a trash rack, coarse-mesh fixed screen, and circulating water pump. The intake canal entrance has an invert at El. 399.0 ft at the entrance and slopes down to El. 391.0 ft at the face of the intake. The CWIS for Units 1 and 2 is about 91 ft wide with an invert at El. 391.0 ft. Trash racks are located at the front of the intake and have 3/8 in. by 3 in. bars spaced 2.5 in. on center. Traveling water screens are located about 12 ft downstream of the trash racks. Each screen is 10 ft wide with a 1/4 in square mesh. The screens are rotated at 11.3 ft/min. Trash and debris are removed from the screens using a front spray wash system. Coarse-mesh fixed screens are located about 10 ft downstream of the traveling water screens and are 11.2 ft wide with a 3/8 square mesh. Circulating water pumps are located about 14 ft downstream of the coarse-mesh fixed screens. The calculations show that highest velocities occur at low water level. At this lake level, the two Unit 1 pumps are each rated at 222 cfs and the three Unit 2 pumps are each rated at 200 cfs, producing a total flow of 1,044 cfs. At this level and full flow conditions, the velocity in the intake canal is about 0.12 cfs directly in front of the screenhouse and increases to a velocity of 0.15 cfs at the canal entrance about 150 ft. in front of the screenhouse.

Velocities approaching the traveling screens were also calculated for each unit at both normal water and low water levels. When maximum velocity occurs at low water level, Unit 1 withdraws 444 cfs and the velocity approaching the screen is about 1.4 fps. The low water level velocity approaching the screens for Unit 2 is 1.3 fps at a flow of 600 cfs.

The through-screen velocity was not calculated since the traveling screen porosity is unknown. It is estimated that the through-screen velocity is approximately twice the screen approach velocity.



Lake Hubbard Steam Electric Station (LHSES)

(2) Design and engineering calculations prepared by a qualified professional and supporting data to support the description listed above.

See the following documentation.

PALCO Engineering & Construction Services
A Division of PALCO Enterprises, Inc.
211 East Beltline Rd., Ste. 103 ♦ DeSoto, TX 75115
Office: 972-223-7676 ♦ Fax: 972-223-7677

VELOCITY CALCULATIONS FOR LAKE HUBBARD UNIT 1

Lake Hubbard Intake Structure contains two (2) intake bays for Unit 1.

Bay 1 contains:

1 Circulating Water Pump	94,000 gpm @ 405' lake level	(ref. Curve N-2929)
	112,000 gpm @ 435.5' lake level	(ref. Curve N-2929)
1 Cooling Water Pump	6,000 gpm	(ref. Curve E-7602)
1 Service Water Pump	800 gpm	(ref. Curve E-7550)

Bay 2 contains:

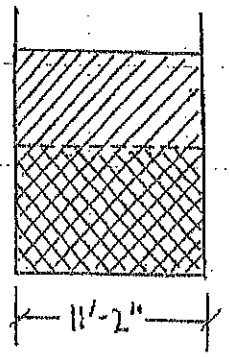
1 Circulating Water Pump	94,000 gpm @ 405' lake level	(ref. Curve N-2929)
	112,000 gpm @ 435.5' lake level	(ref. Curve N-2929)
1 Cooling Water Pump	6,000 gpm	(ref. Curve E-7602)
1 Service Water Pump	800 gpm	(ref. Curve E-7550)

Each Bay has the same dimensions and thus the same cross-section flow area (ref. Dwgs. G-194883 and G-194885 for dimensions and water levels):

@ Normal Water Level EL 435.5'

@ Low Water Level EL 405.0'

Bay Bottom EL 391.0'



$Area_{NWL}$ = (435.5'-391.0')x(11.17')
= 497.1 ft^2

$Area_{LWL}$ = (405.0'-391.0')x(11.17')
= 156.4 ft^2

Maximum Water Velocity is equal for both Bays 1 and 2 and will occur when all pumps are running:

Velocity = Flow Rate / Flow Area

Velocity @ Low Water Level = $\frac{(94{,}000+6{,}000+800)\ \text{gal}}{\text{min}} \Big| \frac{}{156.4\ \text{ft}^2} \Big| \frac{\text{ft}^3}{7.48\ \text{gal}} \Big| \frac{\text{min}}{60\text{s}}$ = 1.4 ft/s

Velocity @ Normal Water Level = $\frac{(112{,}000+6{,}000+800)\ \text{gal}}{\text{min}} \Big| \frac{}{497.1\ \text{ft}^2} \Big| \frac{\text{ft}^3}{7.48\ \text{gal}} \Big| \frac{\text{min}}{60\text{s}}$ = 0.53 ft/s

Carol M. Alston
2/15/06

Unit 1 Circulator

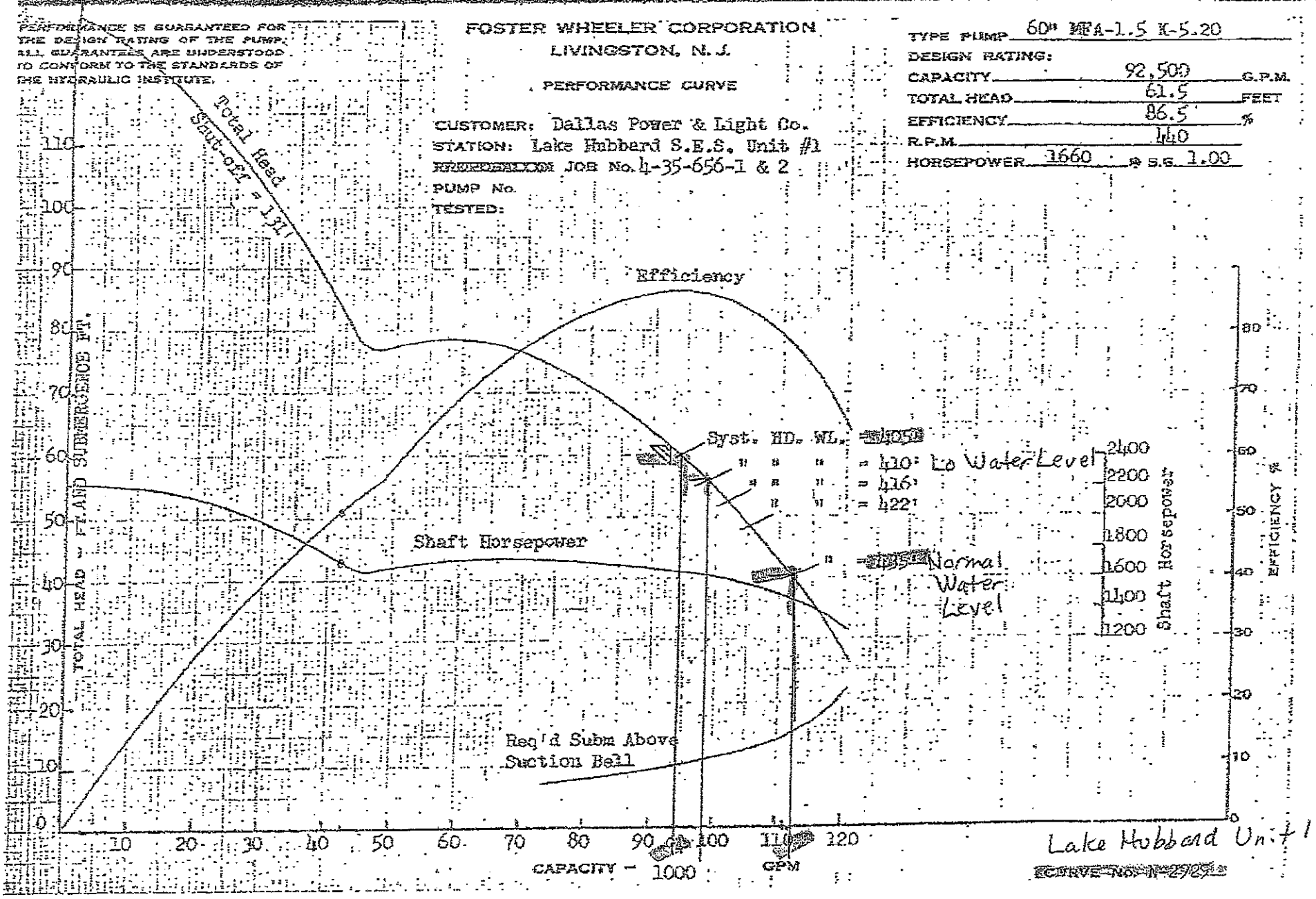
PERFORMANCE IS GUARANTEED FOR THE DESIGN RATING OF THE PUMP. ALL GUARANTEES ARE UNDERSTOOD TO CONFORM TO THE STANDARDS OF THE HYDRAULIC INSTITUTE.

FOSTER WHEELER CORPORATION
LIVINGSTON, N. J.

PERFORMANCE CURVE

CUSTOMER: Dallas Power & Light Co.
STATION: Lake Hubbard S.E.S. Unit #1
JOB No. 4-35-656-1 & 2
PUMP No.
TESTED:

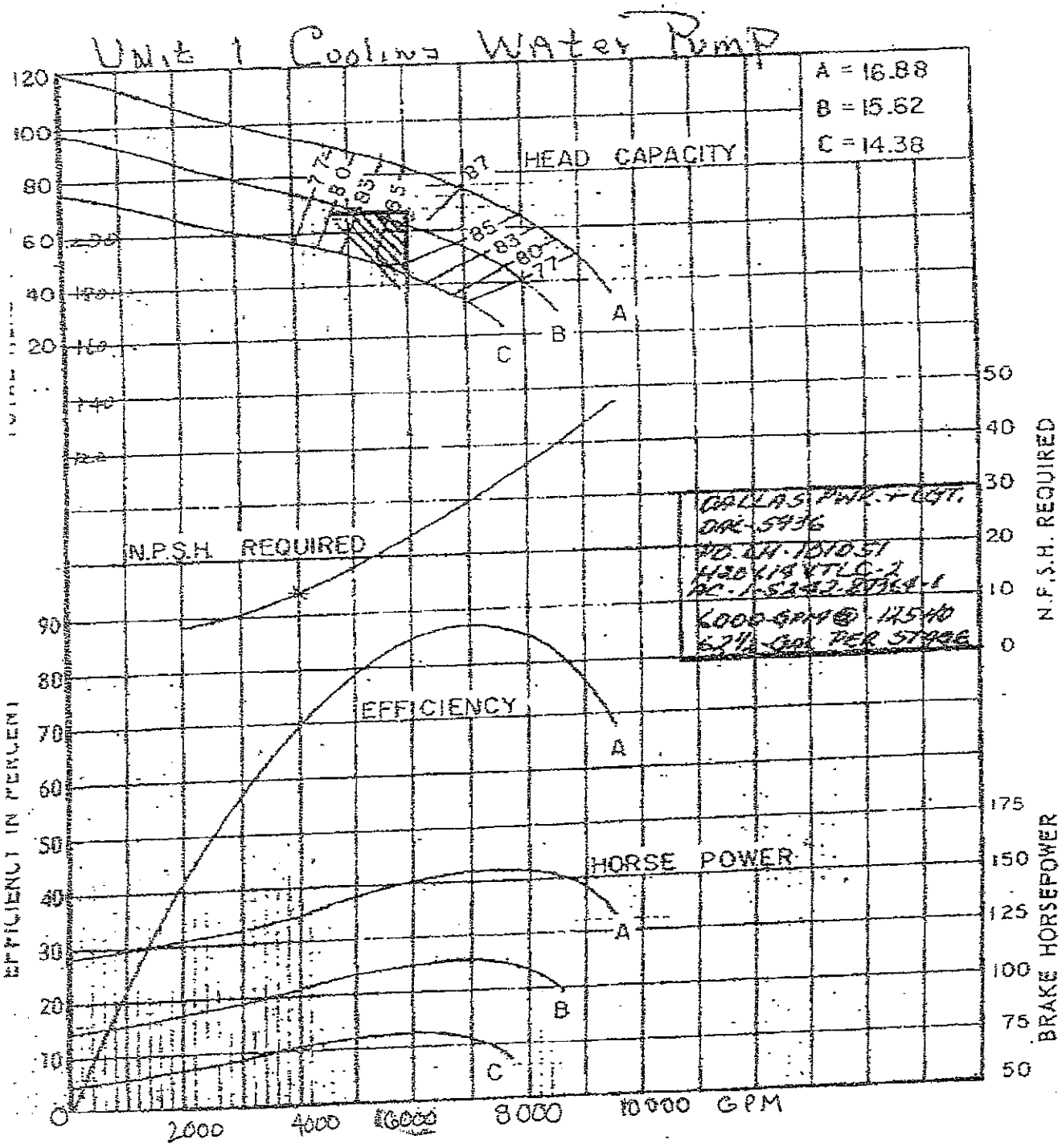
TYPE PUMP 60" MEA-1.5 K-5.20
DESIGN RATING:
CAPACITY 92,500 G.P.M.
TOTAL HEAD 61.5 FEET
EFFICIENCY 86.5 %
R.P.M. 440
HORSEPOWER 1660 @ S.G. 1.00



Lake Hubbard Unit 1

CURVE NO. P-2985

Unit 1 Cooling Water Pump



CURVE NO. E-7602

SIZE H20 VTLC RPM 1170

SINGLE-STAGE LAB HEAD AND HORSE POWER WITH ENAMELED CAST IRON BOWLS AND BRONZE IMPELLER

EFFICIENCY SHOWN FOR 2 OR MORE STAGES. HORSEPOWER SHOWN FOR ONE STAGE BASED ON 2 STAGE

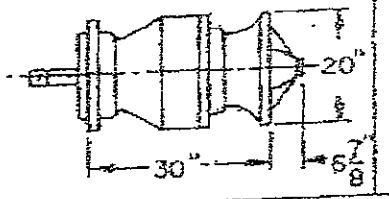
EFFICIENCY CORRECTIONS SHOULD BE MADE FOR STAGES AND MATERIAL

NO. STAGES	EFF. CHANGE	MATERIAL	EFF. CHANGE
1	-1	IMP.-CI	0
2	0	IMP.-C... ENM.	0
3	0	BOWL-CI	-1
4	0	BOWL-BRZ	-1

EYE AREA - SQ. IN	94
THRUST CONSTANT - A	38.8
THRUST CONSTANT B	38.8
THRUST CONSTANT C	38.8
WR² PER IMPELLER	22 LB.-FT.²
MAX SPHERE SIZE	2.0
MAX NO. STD STAGES	9
MAX OPERATING PSI	400
STD LATERAL	687
STD. SHAFT DIA	2.687
IMPELLER NUMBER	P-27 24-10
IMPELLER WT. - LBS.	90
BOWL CONN - FLANGED	

ADD 19 3/8" PER ADDITIONAL STAGE

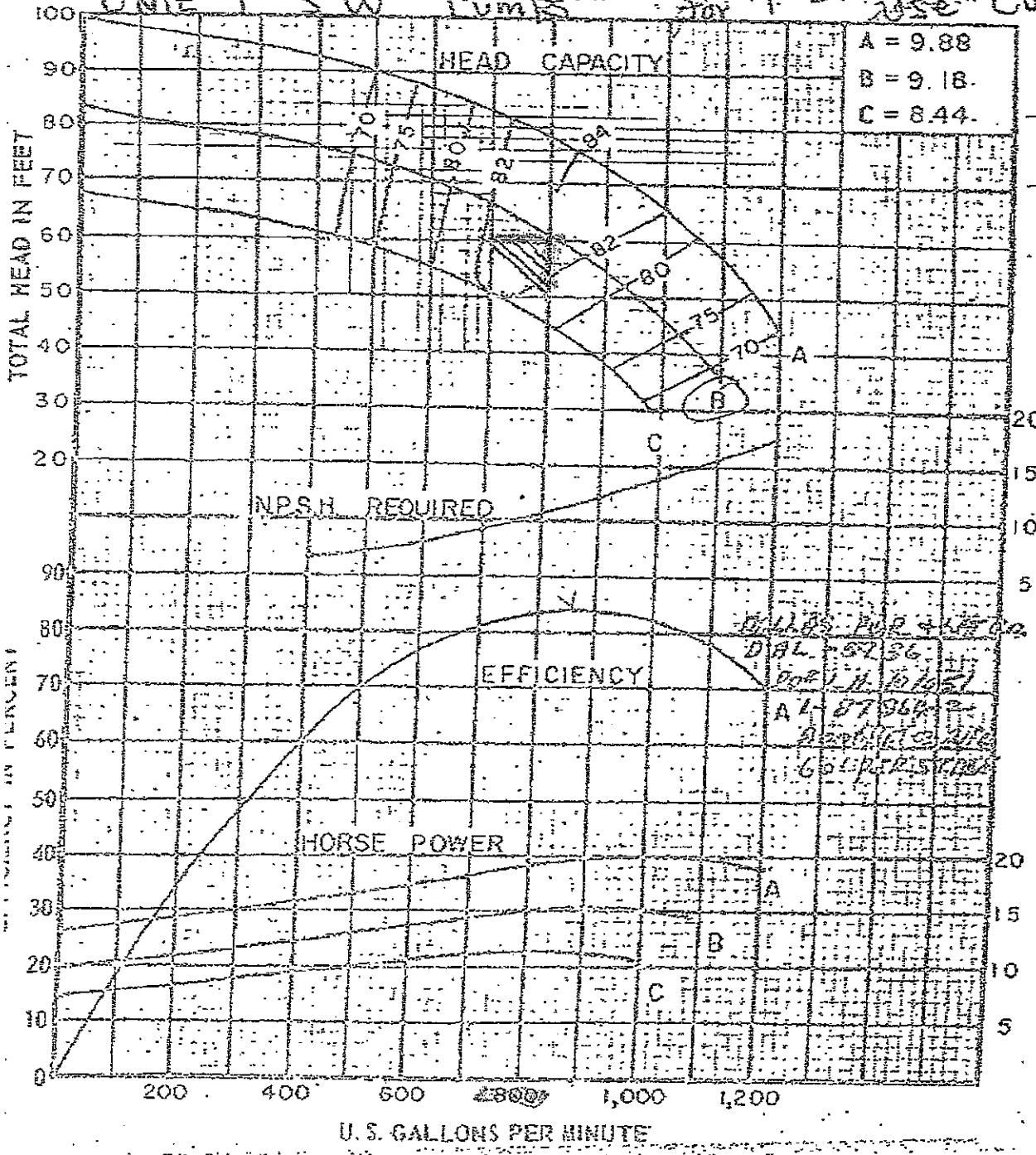
ENCLOSED LINE SHAFT & OPEN LINE SHAFT



Lake Hubbard Unit 1

ALLIS-CHALMERS

Unit 1 SW Pumps this curve for 1 stage use Curve B



CURVE NO. E-7550

SIZE MI2 VTSC - RPM 1770

SINGLE-STAGE LAB HEAD AND HORSE-POWER WITH ENAMELED CAST IRON BOWLS AND BRONZE IMPELLER

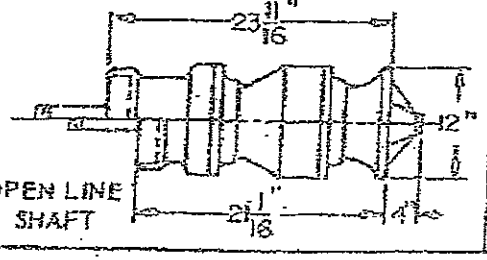
EFFICIENCY SHOWN FOR 2 OR MORE STAGES. HORSEPOWER SHOWN FOR ONE STAGE BASED ON 2 STAGE EFFICIENCY. CORRECTIONS SHOULD BE MADE FOR STAGES AND MATERIAL.

NO. STAGES	EFF. CHANGE	MATERIAL	EFF. CHANGE
1	-1	IMP.-C.I.	0
2	0	IMP.-C.I. ENAL	0
3	0	BOWL-C.I.	-1
4	0	BOWL-BRZ.	-1

EYE AREA - SQ. IN.	= 20
THRUST CONSTANT - A	= 9.2
THRUST CONSTANT - B	= 9.2
THRUST CONSTANT - C	= 9.2
WR² PER IMPELLER	= 1.67 LB-FT.²
MAX. SPHERE SIZE	= .968
MAX. NO. STD. STAGES	= 11
MAX. OPERATING PSI	= 460
STD. LATERAL	= .375
STD. SHAFT DIA.	= 1.687
IMPELLER NUMBER	= P-2363
IMPELLER WT. - LBS.	= 18.6
BOWL CONN. - FLANGED	

ADD 10 3/4" PER ADDITIONAL STAGE

ENCLOSED LINE SHAFT



ALLIS-CHALMERS

Lake Hubbard Unit 1

PALCO Engineering & Construction Services
A Division of PALCO Enterprises, Inc.
211 East Beltline Rd., Ste. 103 ♦ DeSoto, TX 75115
Office: 972-223-7676 ♦ Fax: 972-223-7677

VELOCITY CALCULATIONS FOR LAKE HUBBARD UNIT 2

Lake Hubbard Intake Structure contains three (3) intake bays for Unit 2. Unit 2 was designed for a low lake level of 410'; however, since Unit 1 was designed for a low level of 405', this more conservative low lake level will be used in the calculations.

Bays 1 and 2 each contain:

1 Circulating Water Pump	90,000 gpm @ 405' lake level estimate	(ref. Curve 61176)
	140,000 gpm @ 435.5' lake level	(ref. Curve 61176)
1 Service Water Pump	700 gpm	(ref. Curve A19103)

Bay 3 contains:

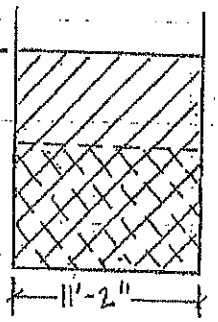
1 Circulating Water Pump	90,000 gpm @ 405' lake level estimate	(ref. Curve 61176)
	140,000 gpm @ 435.5' lake level	(ref. Curve 61176)

Each Bay has the same dimensions and thus the same cross-section flow area (ref. Dwg. E-45040 for dimensions and water levels):

@ Normal Water Level EL 435.5'

@ Low Water Level EL 405.0'

Bay Bottom EL 391.0'



$Area_{NWL}$ = (435.5'-391.0')x(11.17')
= 497.1 ft^2

$Area_{LWL}$ = (405.0'-391.0')x(11.17')
= 156.4 ft^2

Maximum Water Velocity is equal for Bays 1, 2, and 3 and will occur when all pumps are running:

Velocity = Flow Rate / Flow Area

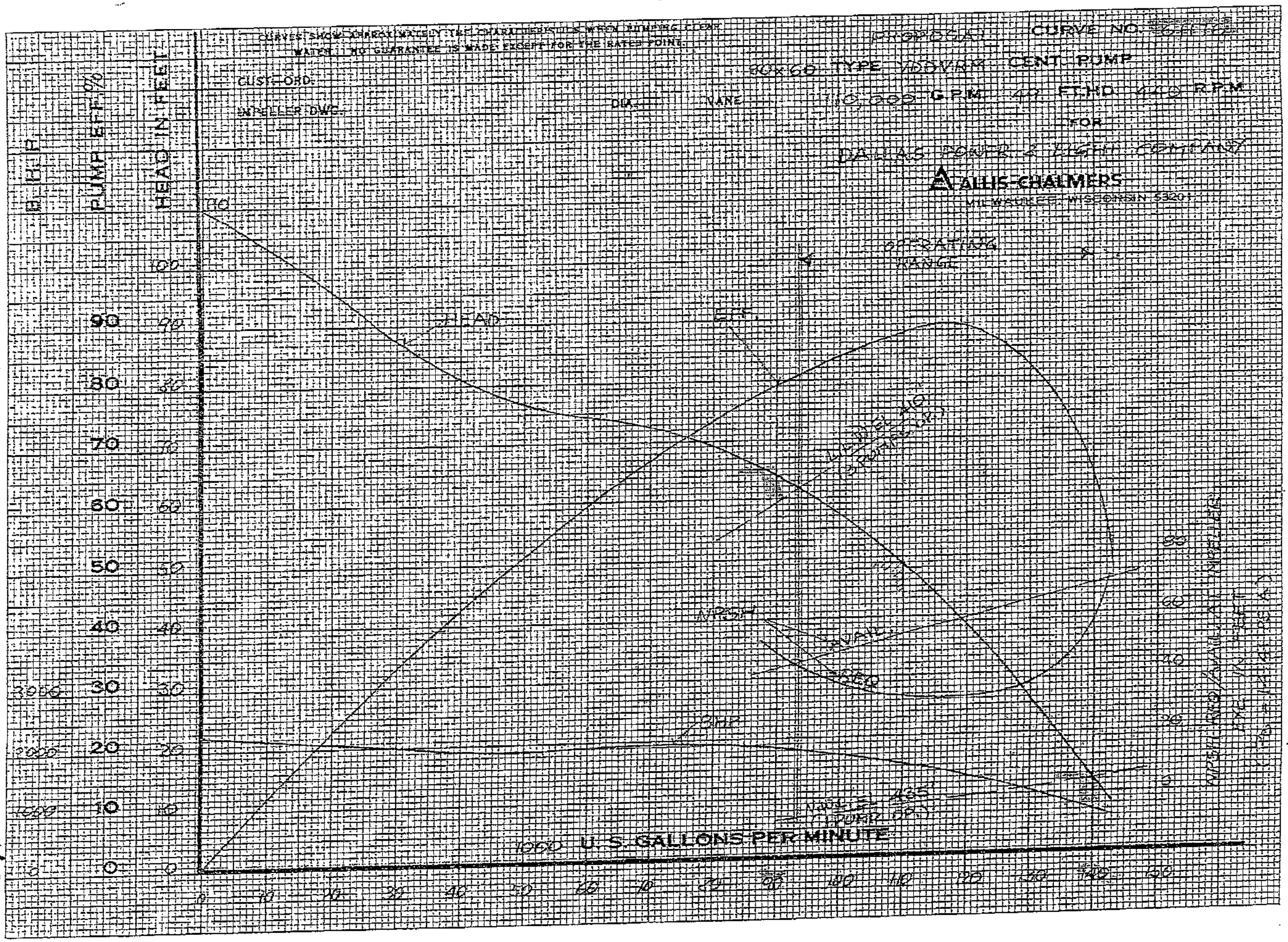
Velocity @ Low Water Level = $\frac{(90{,}000+700)\ \text{gal}}{\text{min}} \Big| \frac{}{156.4\ \text{ft}^2} \Big| \frac{\text{ft}^3}{7.48\ \text{gal}} \Big| \frac{\text{min}}{60\text{s}}$ = 1.3 ft/s

Velocity @ Normal Water Level = $\frac{(140{,}000+700)\ \text{gal}}{\text{min}} \Big| \frac{}{497.1\ \text{ft}^2} \Big| \frac{\text{ft}^3}{7.48\ \text{gal}} \Big| \frac{\text{min}}{60\text{s}}$ = 0.63 ft/s

Carol Ann Alsop
2/15/06

CLEARPRINT CHARTS

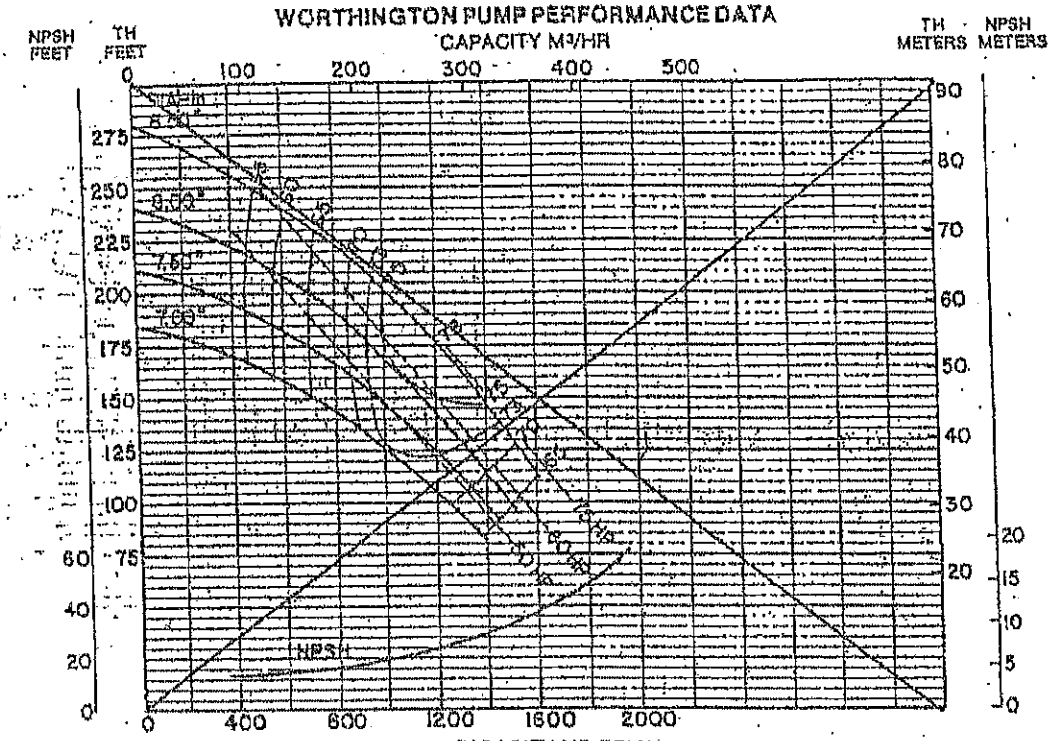
Form 1674–6
Printed in U.S.A.


CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT.
PROPOSAL
CURVE NO.
80x60 TYPE VDDVRM CENT. PUMP
CUST. ORD.
IMPELLER DWG.
DIA.
VANE
10,000 G.P.M.
40 FT. HD.
440 R.P.M.
FOR
DALLAS POWER & LIGHT COMPANY
ALLIS-CHALMERS
MILWAUKEE, WISCONSIN 53201
OPERATING RANGE
B.H.P.
PUMP EFF. %
HEAD IN FEET
HEAD
EFF.
NPSH
AVAIL.
REQ.
BHP
U.S. GALLONS PER MINUTE
1000

Customer Texas Utilities Generating — Worthington S.O. Dallas
Project Lake Ray Hubbard — Proposal/Order No. 69-70016
Cust. Proposal/Order No: 6C5-25951 — Certified By TK
Customer Item No. ACWBP #1 & 2 — Date 3-27-87

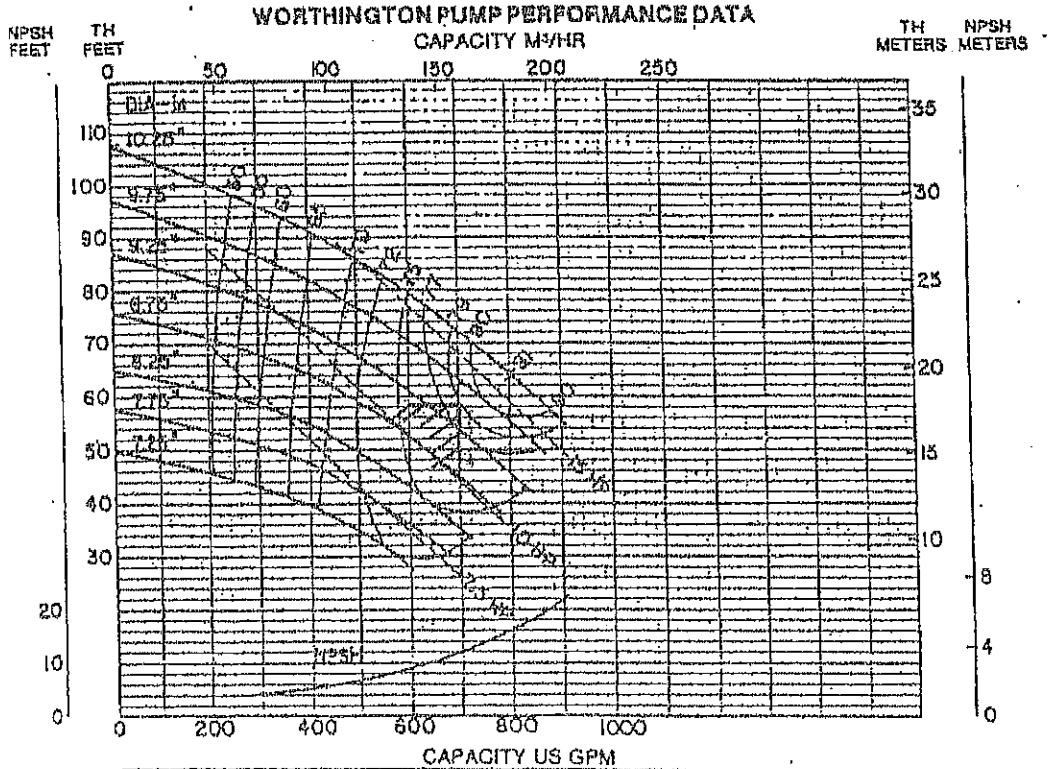
Liquid/Service Water — Sp. Gr. 1.0 — Visc. — SSU
Capacity 100 — Head 58 — Temp. Amb °F/°C — Consistency — %

WORTHINGTON PUMP PERFORMANCE DATA



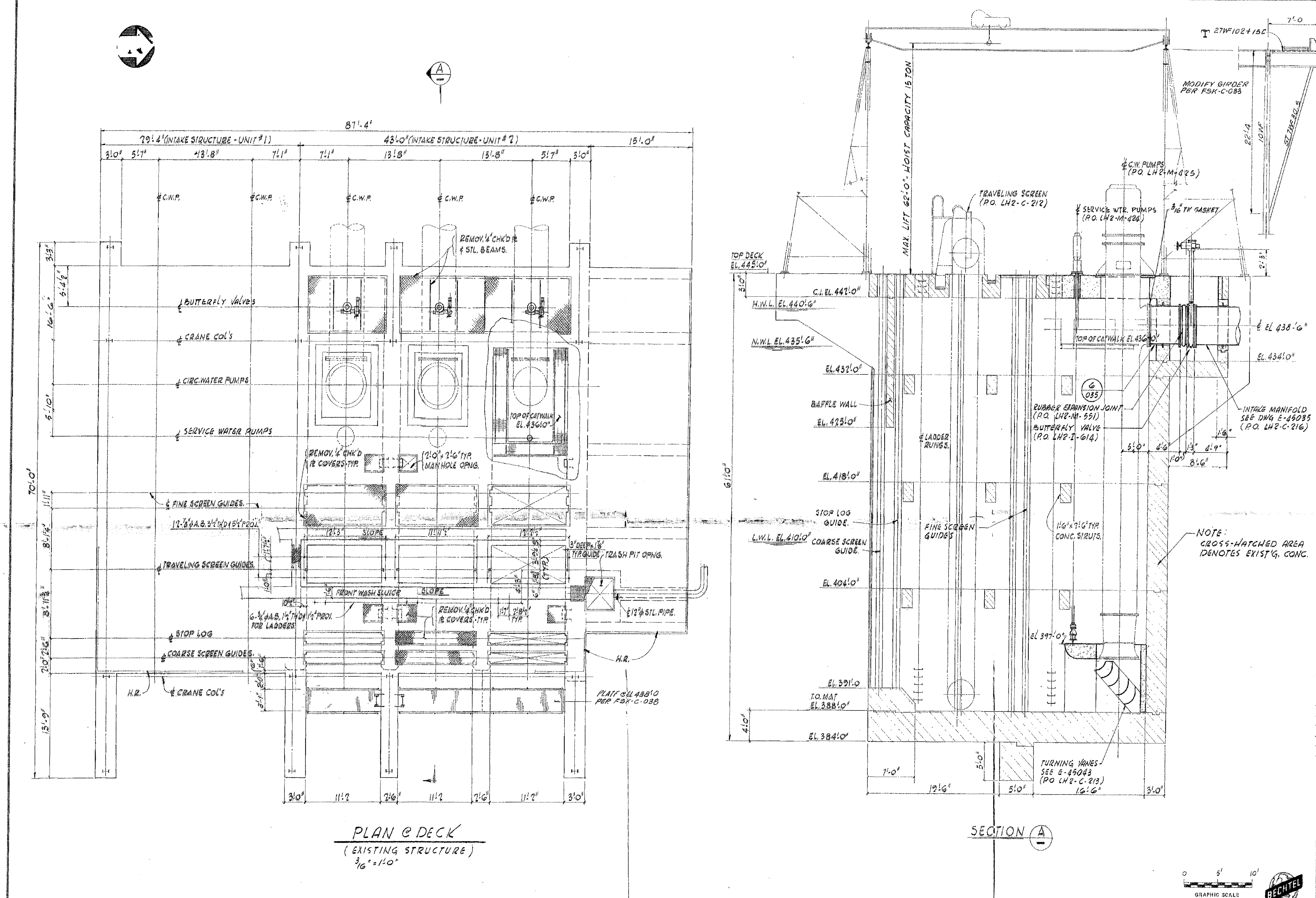
MODEL	SIZE	RPM	CURVE NO.	MAX. SOLIDS
4LR-10	IMP G	3550	A19102	.50 DIA

WORTHINGTON PUMP PERFORMANCE DATA



MODEL	SIZE	RPM	CURVE NO.	MAX. SOLIDS
4LR-10	IMP G	1760	A19103	.50 DIA

Unit 2



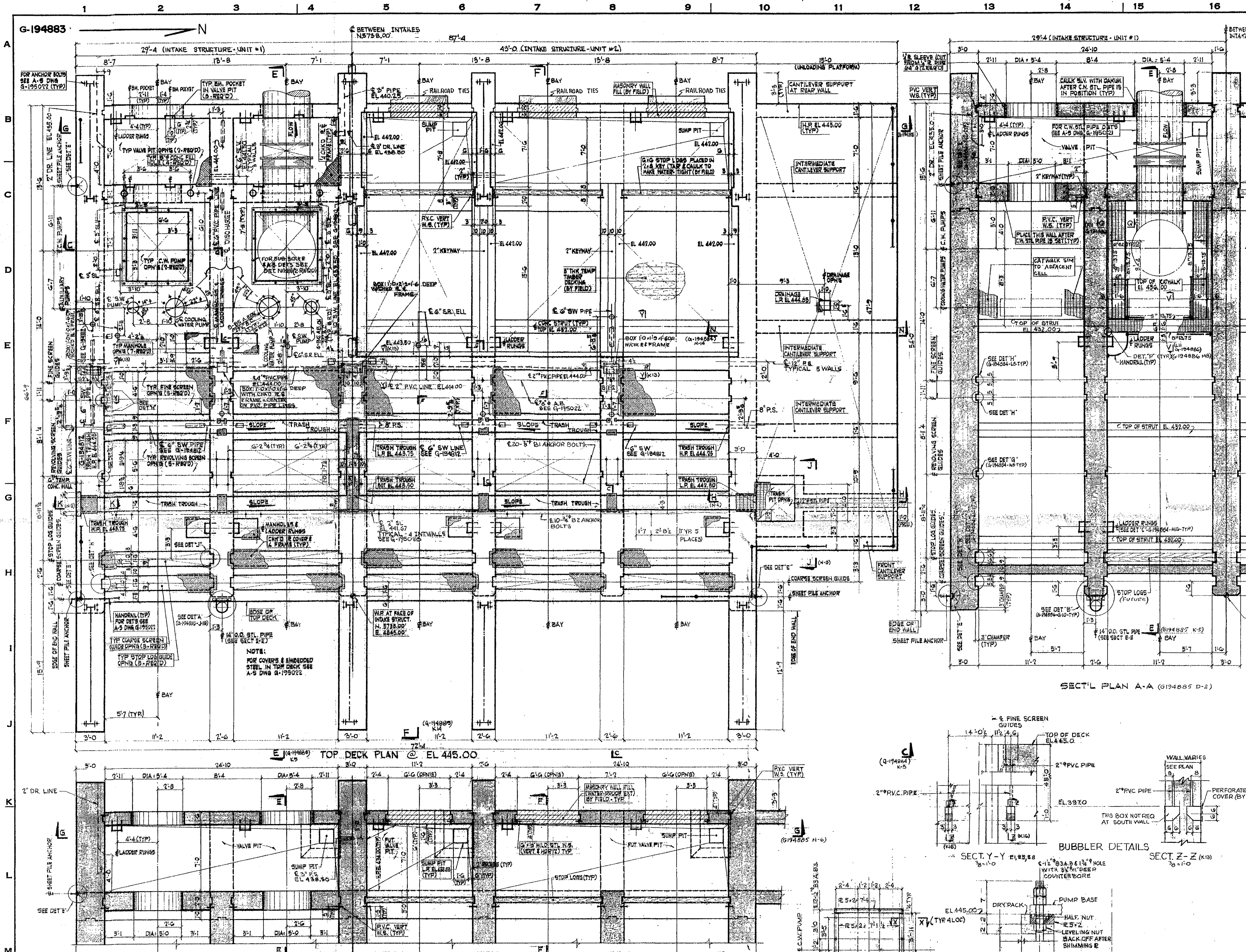
LAKE HUBBARD STEAM ELECTRIC STATION
1974 – 515 MW EXTENSION – UNIT NO 2

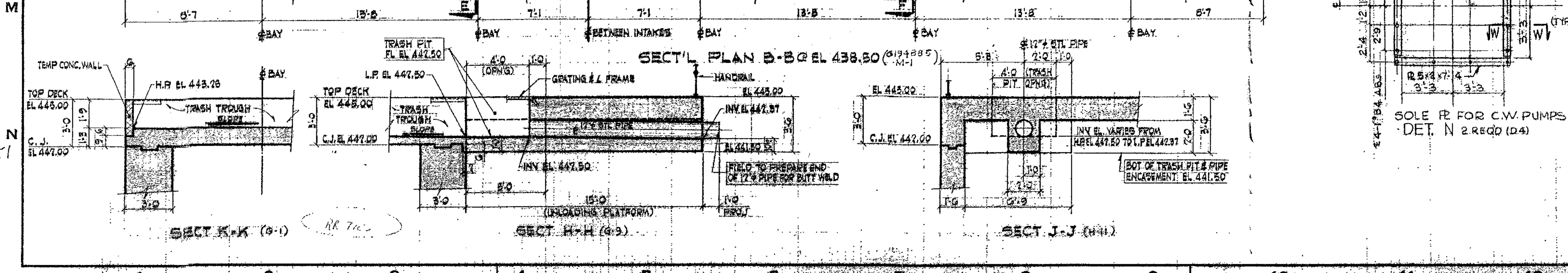
INTAKE STRUCTURE GENERAL ARRANGEMENT

DALLAS POWER & LIGHT CO.
DALLAS, TEXAS

Rev. No.	Revision	Drawn	Engineer	Approved	Approved	Date
1	REV PER FSK-C-033 & C-038 - AS BUILT	HK				3-7-74
0	ISSUED FOR CONSTRUCTION	RAZ				7-13-71
Δ	ISSUED FOR BID	J.H.	AET			9-16-70

Drawn: J. HROVAT
Engineer: J.L. BLACK
Approved: D.H. STEELE
Scale: 3/16" = 1'-0"
E-45040 | 1





ANCHOR BOLT SCHEDULE

TYPE I, TYPE II, TYPE III, TYPE IV, TYPE V, TYPE VI

BOLT						NUT	SLEEVE			ANCHOR ℞		TOP ELEV. BOLT
MARK	NO.	DIA.	TYPE	LENGTH	LENGTH OF THR'D	NO.	NO.	DIA.	LENGTH	NO.	SIZE	
B1	20	7/8	III	2'-5	3½	20	—			—		445.46
B2	10	3/4	III	11	1½	10						445.12
B3	24	1½	IV	3'-5	11	96*				24	8x14x6	445.58
B4	8	1	IV	1'-9	4	16**				8	4x½x4	444.99
B5	16	1¼	VI	3'-0	3	16						445.50
B6	8	1	VI	2'-6	3	8						445.42

FOR ADDITIONAL ANCHOR BOLTS SEE A-5 DWG G-195022
*SEE SECT.W-W (M14) ** SEE SECT.X-X (N14)

QUANTITIES (NET BY FIELD UNLESS NOTED)

CONCRETE CLASS "B" (3,000 P.S.I.)*	2429 CU.YD.
6"x⅜" MILD STEEL WATERSTOP	290.00 LIN.FT.
P.V.C. WATERSTOP	140.00 LIN.FT.
LADDER RUNGS (AS PER DET "C")	592 REQ'D
14"⌀O.D. STL. PIPE FLOAT WELL (AS PER SECT E-E & DETS A&B)	1-REQ'D
64"⌀x¼"THK PIPE SLV. (SEE SECT'L PLAN A-A)	2-REQ'D
SHEET PILE ANCHOR (AS PER DET "E")	133.00 LIN.FT.
SHEET PILE ANCHOR (AS PER DET "F")	35.00 LIN.FT.
CRIBBING BEARING ℞ & 4x3∠ ASSEM (AS PER DET "D")	56.00 LIN.FT.
PRECAST CONC COVER (AS PER DET "K")	2-REQ'D
10" FINE & COARSE SCREEN GUIDES (AS PER DET "H")	1673.10 LIN.FT.
12" STOP LOG GUIDE (AS PER DET "J")	537.70 LIN.FT.
EDGE PROTECTION - 3x3∠ (AS PER DET "L")	150.00 LIN.FT.
12"⌀ STL. PIPE (AS PER SECT H-H)	12.00 LIN.FT.
LIFTING HOOKS (AS PER DET "M")	8-REQ'D
6"⌀ P.V.C. PIPE	28 LN.FT.
4"⌀ P.V.C. PIPE	15 LN.FT.
2"⌀ P.V.C. PIPE	515 LN.FT.
SUB-SOLE PLS PER DETN. N II	2-REQ

ANCHOR BOLTS PER ANCHOR BOLT SCHEDULE

*CONCRETE QUANTITY DOES NOT INCLUDE BOTTOM MAT AND 5'-0 x 5'-0 SHEAR KEY, WHICH ARE COVERED ON DWG G-194886.

ALL HANDRAILING, GRATING AND STRUCT STEEL SHOWN FOR CATWALK TO BE FURNISHED BY FIELD

QUANTITIES CONTINUED ON G-194884

NOTES

CONCRETE SHALL BE CLASS "B" (3,000 P.S.I.) SEE EBASCO SPECIFICATION 14-G5 CONCRETE MASONRY.

WATER STOPS TO BE CONTINUOUS, SPLICES TO BE LAPPED & WELDED.

ALL ANCHOR BOLTS, DRAIN PIPES, PIPE SLEEVES, ELECTRICAL CONDUITS AND EMBEDDED PARTS SHALL BE IN POSITION BEFORE CONCRETE IS PLACED.

CURRENT ACI STANDARDS SHALL GOVERN FOR ALL DESIGN AND CONSTRUCTION UNLESS OTHERWISE NOTED.

ANCHOR BOLTS SHALL BE SET ACCURATELY IN POSITION BY MEANS OF A RIGID TEMPLATE.

ALL CONCRETE FILL AS SHOWN SHALL BE PLACED TRUE & LEVEL IN ACCORDANCE WITH SPECIFIED DIMENSIONS AND ELEVATIONS.

FOR INTAKE C.W. STEEL PIPING (LAYOUT & DETAILS) SEE A-5 DWG G-195021

FOR ADDITIONAL ANCHOR BOLTS, CHK'D ℞ COVERS, GRATINGS & FRAMES CATWALK, ALL GUIDE DET'S, HANDRAILS, ETC. SEE A-5 DWG G-195022

FOR INTAKE STRUCTURE REINF SEE DWG G-194880, 887, 888.

W.S. DENOTES WATER STOP

WATER STOP TO BE EITHER 6"x⅜" MILD STEEL OR POLYVINYLCHLORIDE (P.V.C.) AS NOTED.

ALL NOTES PERTAINING TO HANDRAILING, GRATING AND STRUCT STEEL APPEARING ON DWG G-195022 SHALL ALSO APPLY TO SAME MATERIALS APPEARING ON THIS DWG.

ALL STRUCT STEEL FOR CATWALKS SHALL BE CLEANED AND SHOP PAINTED WITH ONE COAT OF ZINC RICH PAINT IN ACCORDANCE WITH EBASCO COATING GUIDE CP-21 REV 3.

DRY PACK GROUT SHALL BE USED UNDER ALL BASE & SOLE P.S. LEVELING NUTS FOR BASE OR SOLE P.S. SHALL BE BACKED OFF AFTER GROUTING.

ALL JACKSCREWS & SHIMS SHALL BE REMOVED FROM UNDER PLATES AFTER GROUT HAS SET.

REFERENCE DRAWINGS

LIST OF DRAWINGS	A-194764
C.W.S. - CANALS - PLAN	G-192755
PLANT ROADS, GRADING & DRAINAGE PLAN	G-194877
C.W.S. - GENERAL PLAN & PROFILE	G-194887
C.W.S. - INTAKE STRUCTURE - M - SH 2	G-194884
C.W.S. - INTAKE STRUCTURE - M - SH 3	G-194885
C.W.S. - INTAKE STRUCTURE - MAT & MISC. DET'S - M&R	G-194886
C.W.S. - INTAKE & DISCHARGE STRUCTURES - CRIBBING	G-194889
C.W.S. - INTAKE STRUCTURE BLOCK - M	G-194891
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STEEL CIRC WATER PIPE	G-195021
INTAKE STRUCTURE PIPING - PLANS & SECT'S (ME)	G-194812
INTAKE STRUCTURE - CONDUIT GRDG & LTG. PLAN (E)	G-195083
CIRC. WATER PUMP OUTLINE (F-W)	5936-142
COOLING WATER PUMP OUTLINE (A-C)	5936-629
SERVICE WATER PUMP OUTLINE (A-C)	5936-436

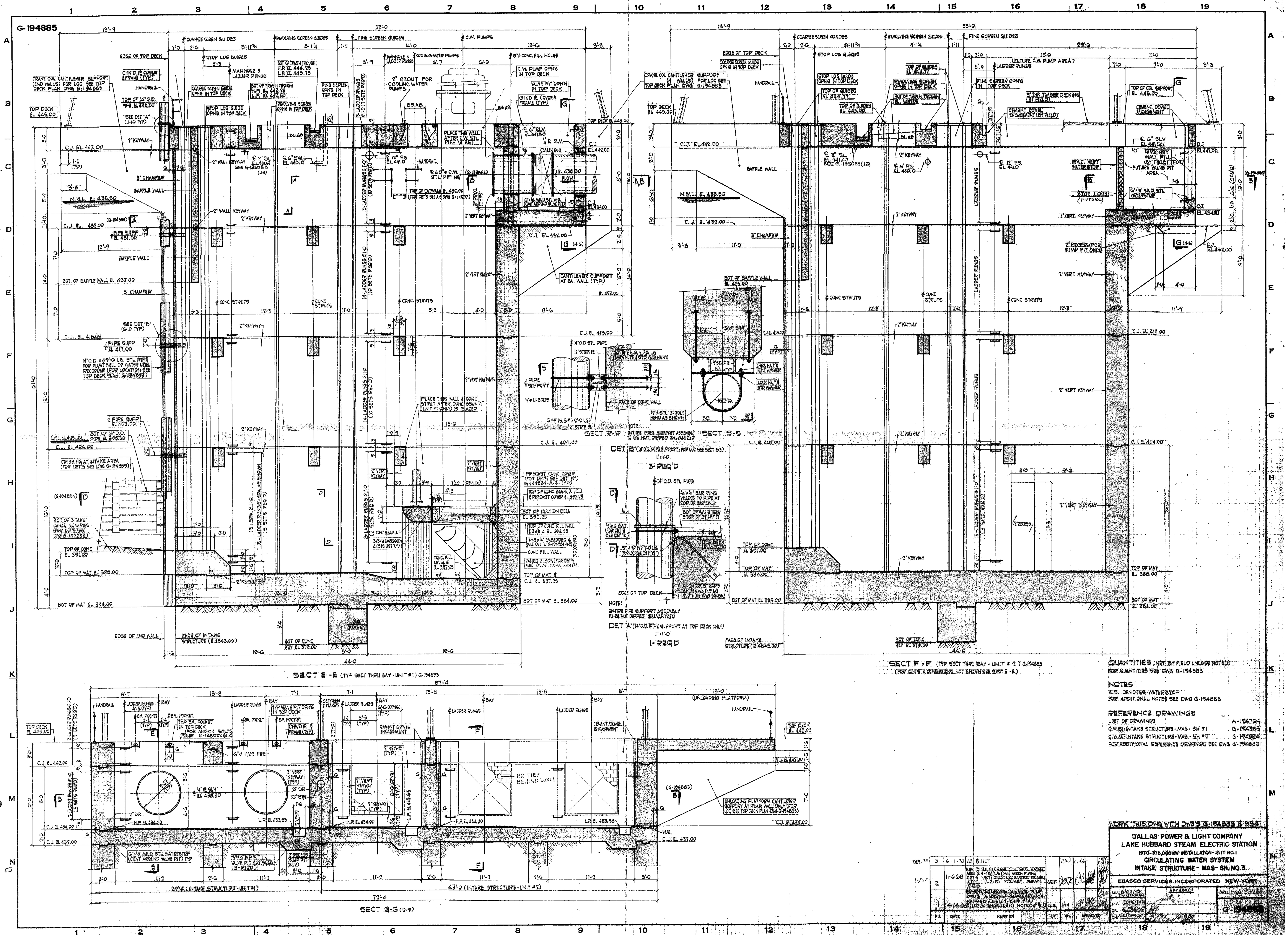
NO.	DATE	REVISION	BY	CH.	APPROVED
3	6-1-70	AS BUILT	RLG	RTW	CHG
2	11-6-68	RELOC: (D5, D3) P.V.C. PIPE LINE; REV: (B1-10)(J1-10)(K1-10) CRANE COLUMN SUP. (E1-4) AUX. PUMP OPNGS. (D-18) QUAN. ADDED (B1-5, D1-5, F1-9, G-9) MECH. PIPE DET'S (F1-10) SCREEN WASH SUP. A.B. (E1-4) AUX. PUMP A.B.'s (J18) NOTES; RELEASED (D2, D4) COOLING WATER PUMPS; REVISED (E4, E14, E6) LOCATION OF MANHOLE & LADDER RUNGS	JRF	JOK	
1	4-24-68	ADDED: G18 QUANT; I18 NOTES; L18 REF DWGS; D15 PLTFORM STL; N11 DET N; N14 SECT W-W; M14 SECT X-X; K13 SECT Y-Y; K14 SECT Z-Z; G1-8 A.B. B1; B1-8 BUBBLER SYSTEM; RELEASED: D5 C.W. PUMP OPENINGS; G1-12 REVOLVING SCREEN OPENINGS	G.M.F.	MN	

WORK THIS DWG WITH DWG'S G-194884 & 885

DALLAS POWER & LIGHT COMPANY
LAKE HUBBARD STEAM ELECTRIC STATION
1970-375,000 KW INSTALLATION-UNIT NO. 1
CIRCULATING WATER SYSTEM
INTAKE STRUCTURE - MAS - SH. NO. 1

EBASCO SERVICES INCORPORATED NEW YORK

SCALE: ⅛"=1'-0 (UNLESS NOTED) | APPROVED | DATE JAN. 1968
DIV. CONC.-HYD
DR. A. Pallino
CH. R.J. Simmons
D.P.&L. Co. No. G-194883


G-194885
SECT E-E (TYP SECT THRU BAY - UNIT #1) G-194883
SECT F-F (TYP SECT THRU BAY - UNIT # 2) G-194883
(FOR DET'S & DIMENSIONS NOT SHOWN SEE SECT E-E)
SECT G-G (Q-9)
SECT R-R
SECT S-S
DET "B" (14"O.D. PIPE SUPPORT - FOR LOC SEE SECT E-E)
3-REQ'D
DET "A" (14"O.D. PIPE SUPPORT AT TOP DECK ONLY)
1-REQ'D
NOTE: ENTIRE PIPE SUPPORT ASSEMBLY TO BE HOT DIPPED GALVANIZED
QUANTITIES (NET BY FIELD UNLESS NOTED)
FOR QUANTITIES SEE DWG G-194883
NOTES
W.S. DENOTES WATERSTOP
FOR ADDITIONAL NOTES SEE DWG G-194883
REFERENCE DRAWINGS
LIST OF DRAWINGS A-194764
C.W.S.-INTAKE STRUCTURE-MAS-SH #1 G-194883
C.W.S.-INTAKE STRUCTURE-MAS-SH #2 G-194884
FOR ADDITIONAL REFERENCE DRAWINGS SEE DWG G-194883
WORK THIS DWG WITH DWG'S G-194883 & 884
DALLAS POWER & LIGHT COMPANY
LAKE HUBBARD STEAM ELECTRIC STATION
1970-375,000 KW INSTALLATION-UNIT NO. 1
CIRCULATING WATER SYSTEM
INTAKE STRUCTURE - MAS - SH. NO. 3
EBASCO SERVICES INCORPORATED NEW YORK
3 6-1-70 AS BUILT
2 11-6-68 REV (C1,9,11,K) CRANE COL SUP. EXTG. ADDED (C4-15)(L8)(M1) MECH PIPING DET'S, (B7) COOLING WATER PUMP A.B'S, (L2-5) POCKET BEAM A.B'S.
1 4-24-68 REVISED (AG ABSORBING WATER PUMP OPN'S & LOCATION LADDER RUNGS SHOWED A.B'S (B1, B4 & B13) REL. REV. DIM. (A4 & A14) NOTED (L5)
NO. DATE REVISION BY CH. APPROVED
DIV. CONC-HYD
G-194885

Attachment N

Supplemental Fisheries Data Analysis for Proposal for Information Collection, Clean Water Act, Section 316(b) Phase II Requirements

Luminant Generation Company LLC
Lake Hubbard Steam Electric Station
TPDES Permit No. WQ0001245000

Document No. 050019
PBS&J Job No. 441482

SUPPLEMENTAL FISHERIES DATA ANALYSIS FOR PROPOSAL FOR INFORMATION COLLECTION, CLEAN WATER ACT, SECTION 316(B) PHASE II REQUIREMENTS

Prepared for:

TXU Power
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Prepared by:

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January 2005

Printed on recycled paper

Contents

Figures

Tables

Acronyms and Abbreviations

ANOVA	analysis of variance
CDS	Comprehensive Demonstration Study
CPUE	catch-per-unit-effort
CWIS	cooling-water intake structure
EPA	U.S. Environmental Protection Agency
FWS	U.S. Fish and Wildlife Service
I&E	Impingement and Entrainment
mgd	million gallons per day
PIC	Proposal for Information Collection
SDR	Shoreline Development Ratio
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TXU	Texas Utilities Generating

1.0 BACKGROUND

The Clean Water Act Section 316(b) pertains to Impingement and Entrainment (I&E) of aquatic life at power-generating facilities that withdraw surface water from waters of the U.S. for cooling purposes. The U.S. Environmental Protection Agency (EPA) developed a three-phased approach for rule implementation. Phase I went into effect on January 17, 2002, and regulates new facilities. Phase II regulates existing facilities that withdraw 50 million gallons of water per day (mgd) or more. These regulations went into effect on September 9, 2004. Phase III rules are currently being developed. In Texas, many power-generating facilities withdraw water from reservoirs and are regulated under the Phase II rules. Facilities located on reservoirs are required to meet a performance standard of 80 to 95% reduction in impingement mortality (40 CFR 125.94(b)(1)). The rules provide options for meeting compliance standards and are listed in 40 CFR 125.94(a).

These new rules have been implemented through the Texas Pollutant Discharge Elimination System (TPDES). Through TPDES, many Texas facilities regulated by Phase II rules will be required to submit a Comprehensive Demonstration Study (CDS) (40 CFR125.95(b)) by January 2008. The purpose of the CDS for facilities located on reservoirs is to characterize impingement mortality, describe the operation of the cooling-water intake structure (CWIS), and confirm that the technologies, operational measures, and/or restoration measures selected are meeting or will meet impingement performance standards. One of the first steps in developing a CDS is to prepare and submit a Proposal for Information Collection (PIC) to the Texas Commission on Environmental Quality (TCEQ). Specific components of the PIC are listed in 40 CFR 125.95 (b)(1).

1.1 PHASE II AND TEXAS UTILITIES

Texas Utilities Generating (TXU) owns and operated 18 facilities in Texas that will be regulated by the Phase II rules. All of these facilities are located on reservoirs, most of which were constructed specifically to provide cooling water for "once-through" circulation. All of the source waters for the facilities are classified as waters of the U.S. and will be subject to the Phase II requirements for lakes and reservoirs. These facilities and associated reservoir names are listed below:

Facility Name	Reservoir Name	Stream Channel	Public Access
Hubbard	Ray Hubbard Reservoir	Mainstem	yes
Stryker	Striker Reservoir	Off-channel	yes
Twin Oak		Off-channel	no
Monticello	Monticello Reservoir	Off-channel	yes
Forest Grove		Off-channel	no
De Cordova	Granbury Reservoir	Mainstem	yes
Big Brown	Fairfield Reservoir	Off-channel	yes
Comanche Peak	Squaw Creek Reservoir	Off-channel	no

Facility Name	Reservoir Name	Stream Channel	Public Access
Lake Creek	Lake Creek Reservoir	Off-channel	no
Morgan Creek	Colorado City Reservoir	Off-channel	yes
Martin Creek	Martin Creek Reservoir	Off-channel	yes
North Lake	North Reservoir	Off-channel	no
Tradinghouse	Tradinghouse Creek Reservoir	Off-channel	yes
Trinidad	Trinidad Reservoir	Off-channel	no
Valley Lake	Valley Lake Reservoir (Brushy Creek)	Off-channel	no
Eagle Mountain	Eagle Mountain Reservoir	Mainstem	yes
Graham	Graham Reservoir	Off-channel	yes
River Crest*	River Crest Reservoir	Off-channel	No

*Announced for retirement and will not be considered for 316(b) compliance.
Mainstem – Impoundment of a major river or stream.
Off-channel – Perched reservoir or impoundment of a small stream.

TXU is currently investigating a feasible and practical approach for bringing each of its facilities into compliance under these new rules. Of particular interest is the development of an approach for characterizing aquatic life and monitoring impingement at such a large set of facilities. With the exception of Comanche Peak (Squaw Creek Reservoir), there are little to no recent impingement monitoring data with which to develop required information. Conducting impingement monitoring (and possibly mortality studies) at all of these facilities would be expensive and would present significant logistical challenges. Under the existing deregulated electric supply market, it is difficult and sometimes impossible to know when or whether a facility will be in operation. Some of the smaller facilities have a very low capacity factor, or are inactive, and others have never been completed, but all maintain TPDES permits. Thus, developing a sampling program for every facility would be impractical. On the other hand, some of TXU's facilities are considered "base-loaded" and operate almost continuously, providing good opportunities to conduct thorough impingement demonstration studies. As discussed in the following sections and in the PIC document, these facilities, however, share many similarities, which offer the opportunity to consolidate some of the required data collection for the purpose of estimating facility impacts. With the range of operational scenarios presented by these facilities, TXU proposes to conduct impingement demonstrations at three of its base-loaded facilities: Big Brown (Fairfield Reservoir), Comanche Peak (Squaw Creek Reservoir), and Monticello (Monticello Reservoir). These three facilities would be considered "representative" facilities in which detailed impingement monitoring would be conducted. Data from these facilities and reservoirs would be extrapolated to represent impingement mortality at the remainder of the facilities given that they share acceptable facility, operational, and biological similarities. The purpose of this document is to evaluate and compare available fisheries and habitat data for each reservoir and to determine whether similarities exist between the representative reservoirs and the remainder of the reservoirs. Reservoirs that share similarities (if any) with the representative reservoirs will be grouped accordingly. Information gained from this evaluation will be used as a supplement to the PIC for the purpose of developing impingement demonstration strategies.

1.2 RESERVOIR FISHERIES

TXU facilities are sited throughout east, north, and central Texas and are located in a variety of ecological regions of Texas, as described by Hubbs (1982). These include the East Texas timber country, blackland prairies, cross timbers/grand prairies, and the plains. According to Hubbs et al. (1991), over 150 fish species occur throughout these regions, collectively. Since only one large natural lake occurs in Texas, most of these species are adapted to lotic (stream) systems. Construction of reservoirs on perennial streams alters fish communities through chemical, biological, and physical changes in these systems (Yeager, 1993). Thus, fish communities in reservoirs largely deviate from communities originally found in the pre-impounded reach. Since most large reservoirs across the state are managed for fishing, the introduction of various species for sport-fish management amplifies these changes. A number of tools exist for measuring the health or integrity of natural stream-fish communities. One example is the widely applied Index of Biological Integrity developed by Karr et al. (1986). Because of the "artificial" nature of reservoirs, few studies have focused on reservoirs in this context, which is an important factor when considering data sources for reservoirs (discussed in more detail in Section 2.0). The artificial nature of reservoirs was, in part, the logic the EPA applied when developing the tiered approach for waterbody sensitivity, whereby lakes and reservoirs were considered the least sensitive of the ecosystems categories (EPA, 2004).

Contrary to the above, reservoirs constructed "off channel" or on small, or in some cases ephemeral streams, provide habitat for fish that did not exist in the pre-impounded area. This is particularly true for many off-channel cooling ponds, such as some of the TXU reservoirs. Construction of these facilities and reservoirs created large areas of aquatic habitats, which, in turn, provided the opportunity for Texas Parks and Wildlife Department (TPWD) to stock and manage fish populations for public fishing opportunities. TXU facilities that are currently closed to the public are closed due to security and/or safety concerns, or in some cases, the facilities (and reservoirs) were never completed.

2.0 DATA SOURCES

TPWD maintains fisheries data for the TXU reservoirs open or previously open to the public. Facilities that are no longer open to the public are not currently surveyed by TPWD. Surveys are generally conducted about once every 3 years. In some cases, surveys were conducted at higher frequencies. With the exception of habitat observations, these surveys are standardized between survey years and across reservoirs and fisheries districts. The surveys include boat electrofishing, gill netting, trap netting, and periodic measurements or observations of fish habitat. Each survey takes place within a period of 1 year and each survey technique is typically employed once per survey period. The data are summarized in performance reports required by the Federal Aid in Fisheries Restoration Act. Most of the performance reports contain data summaries from previous surveys. For this study, all performance reports that represent about the last 15 years of data were requested from TPWD. The table below lists all of the survey years that were provided in the performance reports. If a performance report was not provided, it was concluded that data were not available for that reservoir. References for the performance reports used in this study are in Section 5.0.

Reservoir	Performance Report Year(s)
Colorado City	1985, 1988, 1991,1994, 1995, 1997, 2001
Eagle Mountain	1988, 1989, 1990, 1991, 1992, 1995, 1997, 2000
Graham	1983, 1986, 1990, 1994, 1997, 2001
Granbury	1981, 1988, 1990, 1992, 1995, 1998, 2001
Fairfield	1985, 1987, 1988, 1991, 1993, 1996, 1999, 2000
Forest Grove	ND
Lake Creek	1984
Martin Creek	1985, 1991, 1994, 1999, 2000, 2001
Monticello	1987, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999
North	1988, 1991, 1992, 1995, 1998,
Ray Hubbard	1989, 1991, 1994, 1997, 2000,
Squaw Creek	1981, 1988, 1990, 1994, 1997,
Striker	1975, 1988, 1991, 1992, 1993, 1995, 1997, 1999, 2003
Tradinghouse Creek	1987, 1989, 1991, 1994, 1997, 2000
Trinidad	ND
Twin Oak	ND
Valley	ND

ND = Data not available

In addition, the latest reports containing standing crop (cove rotenone) data were also requested. For some reservoirs, creel (angler) surveys were provided, but surveys were available for only a limited number of reservoirs and, therefore, were not considered for this study. A search of the University of Texas Library

and TCEQ archives was conducted to obtain any additional fisheries studies to complement this data set, but none were located.

3.0 DATA HISTORY AND ANALYSIS

Recent data provided for this study allows for some level of spatial and temporal analysis. Multiple data points from the last 15 years or so of data collection were used to develop reasonable statistical analysis. However, there are important factors regarding how these data were collected and the reason other types of data are not available, most of which pertain to the evolution and purposes of fisheries sampling in Texas reservoirs. When evaluating data sets that represent multiple years, or data sets that represent different reservoirs, it is tempting to assume that one data set is directly comparable with the next. This is not necessarily the case due to any number of variables, including constantly changing environmental conditions (i.e., weather, fluctuating water levels, and habitat availability), small sample sizes, stocking, occurrence of invasive species, and sample quality associated with constantly improving sampling techniques. The following section provides a discussion on the later, which is a brief history of fishery sampling in Texas public waters.

3.1 DATA HISTORY

Routine fisheries, water quality, and habitat data have been collected for Texas reservoirs since at least the 1960s. Data collection up to about the mid1980s was quite different than current data collection efforts. During this period, rotenone, seines, and multifilament gill nets were standard sampling tools and a wide suite of water quality parameters were also measured including temperature and dissolved oxygen profiles. Current data collection relies on electrofishing, gill netting, and trap netting. The following paragraphs provide a brief history on each of these sampling techniques.

Cove rotenone – Cove rotenone sampling involved blocking coves of known areas and volumes with block nets and then applying rotenone (fish toxicant) to the sample area. Most of the dead fish eventually floated to the surface and were collected. Data collection included species identification, enumerating, measuring, and weighing the fish. This provided an estimate of standing crop (pounds/acre), numbers of fish per given area, and various population indices. These data were often extrapolated to provide estimates for entire reservoirs or to help assess angler harvest. This technique was quite effective for sampling fish that occur in shallow coves. However, it provided a skewed view of the reservoir standing crop and population composition and structure simply because the fish that occurred in the coves did not necessarily represent fish found in open waters (Nielsen and Johnson, 1985). Due to public concern over killing large numbers of fish and the evolution of alternative, less damaging sampling techniques, the use of cove rotenone surveys ceased by the late 1980s. Because cove rotenone surveys, although quite dated, are some of the only data that provide quantitative assessments of fish populations, the latest (most recent) cove rotenone data were obtained (if available) for each reservoir for this study. With some broad assumptions and validation with recent data, the standing crop estimates might provide one tool for estimating impingement rates.

Seine surveys – Seine surveys of shoreline zones were also a standard tool during this period. Seine hauls were made over a known area to provide quantitative estimates of smaller individuals and species that do not attain larger sizes. Similar to cove rotenone data, seine data can provide useful information about the segment of the population subject to impingement. However, seine surveys were discontinued for most reservoirs by the late 1980s. Due to the age and scarcity of these data, seine data were not considered for this study.

Gill netting – Gill netting is a passive sampling tool that has been applied since monitoring began. However, during the late 1980s, the types of gill nets changed. Formerly, gill nets were constructed from multifilament nylon string. Gill nets used today are monofilament, which is considered more effective at capturing fish. Also, during the early 1990s, gill net lengths were slightly shortened. Gill nets are currently constructed with various sizes of mesh within each net and are used to target a variety of fish sizes. Gill nets generally target larger bottom-dwelling and open-water species, most of which are not prone to impingement due to their large size. However, these data provide useful qualitative information about species composition and relative abundance. Gill net data for this study include only data collected using the current gill net configuration. Catch-per-unit-effort (CPUE) (net-night) refers to the number of fish caught in one gill net over about a 24-hour period.

Trap netting – Trap netting is a passive sampling technique used to target sub-adult and adult crappie (*Pomoxis* spp.). TPWD began using trap nets as a standard sampling tool in the early 1990s. Trap net data prior to the 1990s essentially does not exist. Similar to gill nets, trap nets are set out for about a 24-hour period. CPUE refers to the number of fish caught during one net-night. All of the trap net data for the period of records were obtained for this study.

Electrofishing – Boat electrofishing is an effective tool for sampling shallow, shoreline areas. Electrofishing data are largely qualitative, but provide useful information regarding species composition, relative abundance, and individual-specific indices, and can also demonstrate population trends over time. Electrofishing, in turn, can provide information that might be useful for projecting impingement rates, particularly for the sunfish (*Lepomis* and *Micropterus* spp.).

Boat electrofishing technology has greatly improved over time. TPWD began using boat electrofishing in the mid1980s. During this period, the boats were generally small, generators were low wattage and only supplied alternating current, electrode specifications were widely variable, and frequencies were not adjustable. As such, catch rates were relatively low and varied from fisheries district to fisheries district, depending upon the type of electrofishing boat employed. Electrofishing technology rapidly improved, and by the early 1990s TPWD acquired larger, more efficient boats, which were similar between fisheries districts. As a result, electrofishing catch rates increased and data were more comparable between reservoirs. Prior to the mid to late 1990s, electrofishing sampling was conducted at fixed stations. This meant that the stations were selected by the biologists and the same stations were sampled from one survey period to the next. Each station was surveyed for 15 minutes. Existing electrofishing protocol

requires selecting random sampling stations at a higher frequency (number of stations) with a shorter (5-minute) duration. There has been some debate regarding the compatibility of the fixed station and random station data. Most likely, the degree of the impact of changing the sampling protocol probably varies from reservoir to reservoir. The potential spatial and temporal variations should be kept in mind for data evaluation. CPUE for electrofishing is expressed in terms of the number of fish captured during 1 hour of electrofishing. Electrofishing data for the period of record (dating back to the mid 1980s) were obtained for this study.

Habitat – Comprehensive water quality and reservoir profile surveys were conducted up until about the mid 1980s and those data were provided in the earlier performance reports. Existing water quality measurements include surface reading of the basic water quality parameters (temperature, dissolved oxygen, conductivity, and Secchi depth), which are usually taken at each sample station. Approximate conductivities and Secchi depths are listed in Table 1.

Availability (or lack of) of physical habitats play an important role in shaping fish communities (Miller et al., 1987). Variation in habitat might, in part, help to explain variation in fish populations. Physical fish habitats have been documented over the years by TPWD and can be found in most of the performance reports. Habitats can vary widely from year to year due to water level fluctuations, urban development, and the natural and man-induced dynamics of aquatic vegetation coverage. For most of the TXU reservoirs, water levels are maintained within a narrow range of elevations, which helps to reduce the variability induced by changing water levels. Exceptions to this include the reservoirs in the central and western part of the state. TPWD efforts for standardizing habitat data collection have been somewhat hindered due to this variability and the numerous potential combinations of habitat types. Nevertheless, habitats might provide important insight for comparative analysis. The most recent habitat survey for each reservoir was obtained for this study.

3.2 DATA ANALYSIS

Data from the performance reports provided by TPWD were entered into Microsoft Excel spreadsheets. Data fields included reservoir physical characteristics (Table 1), abundance or CPUE of selected species (Table 2), cove rotenone results (Table 3), and habitats surveyed (Table 4). Some winnowing of the fisheries data were required to develop a suite of species that are common across reservoirs and are relevant when assessing impingement. Not all species or sizes of fish are impinged. Since EPA (2004) established ⅜-inch mesh screen as one of the baseline conditions, many smaller species such as silversides (*Menedia* spp.), minnows (*Notropis* and *Cyprinella* spp.), mosquitofish (*Gambusia affinis*), and darters (*Etheostom* and *Percina* spp.) may simply pass through intake screens and do not show up in impingement samples in appreciable numbers. Unlike studies of streams that focus on species diversity, few data are available for non-game species in Texas reservoirs. Survey techniques currently employed by TPWD are biased towards larger species. Some non-game species are collected and reported by TPWD, but their data collection efforts focus on sport fish and the forage species that support sport fish.

Therefore, data on non-game species vary widely and preclude population-level assessments of these species.

Adults of larger species can typically overcome water currents and are usually not impinged. However, catch rates of larger species can provide some insight into potential impingement of juveniles of the same species. In general, the species most prone to impingement in Texas reservoirs are shad (*Dorosoma* spp.) and sunfish (*Lepomis* spp.). These species have high reproductive rates, are generally abundant, and remain of size susceptible to impingement for a large portion of their life.

This study focused on the species most susceptible to impingement and/or common sport fish and forage species. While some of the data were viewed on a species level, the statistical analysis was conducted with groups of like species. This was done to account for spatial variability in species composition of closely related species that occupy comparable niches. These groups are collectively known as the "indicator" species. This grouping generally corresponds to the genus level and are classified as follows:

Species	Grouping
Largemouth bass (*Micropterus salmoides*)	Black bass
Spotted bass (*M. punctulatus*)	Black bass
Gizzard shad (*Dorosoma cepedianum*)	Shad
Threadfin shad (*D. petenense*)	Shad
Bluegill (*Lepomis macrochirus*)	Sunfish
Redear sunfish (*L. microlophus*)	Sunfish
Longear sunfish (*L. megalotus*)	Sunfish
Warmouth (*L. gulosus*)	Sunfish
Green sunfish (*L. cyanellus*)	Sunfish
Orangespotted sunfish (*L. humilis*)	Sunfish
White crappie (*Pomoxis annualris*)	Crappie
Black crappie (*P. nigromaculatus*)	Crappie
Channel catfish (*Ictalurus punctatus*)	Catfish
Blue catfish (*I. furcatus*)	Catfish
White bass (*Morone chrysops*)	Temperate bass
Striped bass (*M. saxatilis*)	Temperate bass
Palmetto bass (*M. chrysops* x *M. saxatilis*)	Temperate bass

3.2.1 Indicator Species Abundance

Temperate bass, crappie, and catfish numbers were low when compared with the number of individuals captured by electrofishing (see Table 2). This is simply due to the sampling techniques employed by TPWD for these species. Temperate bass and catfish are sampled with gill nets and crappie are sampled with trap nets. These sampling tools are passive capture techniques that target larger, sub-adult and adult individuals (Nielson and Johnson, 1986). Numbers of individuals usually decrease with increasing age

class. It is common for most of the individuals in a population to occur within the age-0 class (first year of life), which is the segment of the population that is generally missed by these sampling techniques. Conversely, electrofishing is a sampling technique that actively pursues fish of a wide range of sizes. While many smaller age-0 fish can be easily overlooked during electrofishing, larger age-0 fish can be represented in samples, depending on the species. Electrofishing is effective for capturing sunfish, black bass, and shad (when present along the shoreline). Figure 1 illustrates the electrofishing catch rates of these species by reservoir. Electrofishing catch rates are based upon the mean of all sample events. In general, the representative reservoirs represent the high (Monticello Reservoir), mid (Fairfield Reservoir), and lower (Squaw Creek Reservoir) ranges of the abundance of these species. However, the variability in abundance appears to be wide from year to year, as illustrated for selected species in Figure 2. This variability can be the result of the combination of factors, such as reservoir water level changes (available habitat), variability in population sizes, increased electrofishing efficiency over time, and the change from fixed-station sampling to random sampling. Relative abundance of black bass, shad, and sunfish were consistently low in electrofishing samples taken at Squaw Creek Reservoir. This is somewhat surprising because anecdotal information indicate that when the reservoir was open to the public, it was considered one of the state's best bass fishing lakes. TPWD (Floyd Teat, personnel communication) suggests that electrofishing catch rates are low at Squaw Creek Reservoir due to the high conductivity, step shorelines, and exceptionally clear water, which significantly decreased sampling efficiency. Thus, electrofishing samples might not be truly representative of the fish community.

Some additional generalities can be drawn from the data without detailed analysis. Since most of these reservoirs are not located on large rivers or streams, white bass (*Morone chrysops*) are either not present or occur in low numbers in these reservoirs (i.e., cooling ponds). The exceptions to this are lakes Eagle Mountain, Ray Hubbard, and Colorado City, which support appreciable numbers of white bass (Table 2). Eagle Mountain and Ray Hubbard reservoirs are large impoundments of rivers, which tend to maintain viable white bass populations. Striped bass (*M. saxatilis*) are absent or do not occur in large numbers in any of the reservoirs. Striped bass are not native to the areas where these reservoirs are located and only occur where they are stocked. Palmetto bass (*M. chrysops* x *M. saxatilis*), similar to striped bass, occur in a few of the reservoirs, but they only exist due to stocking. Since the reproductive potential of temperate bass for most of these reservoirs is very low to nonexistent, it would make sense to exclude these species as indicators. However, some consideration should be given to the reservoirs that support viable populations of white bass. Similar to the temperate bass, data indicate that crappie (*Pomoxis* spp.) are generally scarce in most of the reservoirs. The exceptions to this are Eagle Mountain, Graham, and Granbury reservoirs where appreciable numbers of crappie have been collected. In general, crappie do not thrive in reservoirs that were constructed as cooling ponds. TPWD attempted to establish crappie fisheries in many cooling ponds in the 1990s by introducing hybrid white (*P. annualris*) x black (*P. nigromaculatus*) crappie. However, their data indicated that the hybrids did not increase the crappie populations. The earlier cove rotenone data (see Table 3) also indicate that crappie populations were

historically low for most of the reservoirs. Anecdotal information from TXU staff indicate that anglers do catch crappie in some of the reservoirs, even though TPWD data indicates the populations are low.

Channel catfish (*Ictalurus punctatus*) are abundant in most of the reservoirs. Flathead catfish (*Pylodictis olivaris*) were considered; however, few reports contained data on this species. The data that were present indicated low abundance of this species across reservoirs. Blue catfish (*I. furcatus*) are generally absent from most of the reservoirs (see Table 2) because they are inhabitants of big rivers and are usually not found in small watersheds (Robison and Buchanan, 1992), unless they are stocked. Ray Hubbard is the only reservoir that maintains a large population of blue catfish. Even though channel catfish are abundant, the potential impingement rate of this species is questionable. Informal observations of intake screens at TXU and other facilities indicate that channel catfish impingement is typically low.

One detail that is not represented in the data is the impact that golden algae (*Primnesium parvum*) have had on the fisheries in Colorado City and Granbury reservoirs. It would be difficult to determine quantitative effect on these reservoirs, but it is very possible that the recent sampling data do not represent the post fish-kill environments. However, the magnitude of the fish kills on Colorado City Reservoir was considered higher than the fish kills on Granbury Reservoir. In either situation, the actual numbers of fish susceptible to impingement might be low.

Based on available data, sunfish, shad, and black bass survey results might be the most appropriate data set for comparing reservoirs fish communities in relation to impingement. Compared with the inherent bias of capturing larger fish with gill nets and trap nets, electrofishing data likely represent the portion of the fish community vulnerable to impingement. This does not necessarily mean that the species targeted by gill nets and trap nets are not important to consider, but extrapolating the juveniles of those species would add a level of uncertainty. On the other hand, electrofishing data provide a direct measure of the relative abundance of target species. The catfish, temperate bass, and crappie data were compared between reservoirs, as discussed in the following section. However, these species were not used for developing habitat to fisheries relationships, as discussed in Section 3.2.3.

3.2.2 Analysis of Recent Data

CPUE data (electrofishing, gill netting, and trap netting) for various species were available from about 1986 to 2003 for 12 reservoirs (see Table 2). These data represent multiple years of data collection and the number of data points for the reservoirs ranged from 5 to 11. An analysis was performed to determine whether there is a statistically significant difference between the mean CPUEs of any pair of reservoirs. The analysis was performed for each of the indicator species.

The first step was to check whether the variance increased with the mean. Such condition would affect the validity of the results. The variance was stabilized with either logarithmic transformation or square-root transformation. The data were log-transformed when there was no zero in the data set; otherwise, the square-root transformation was used.

Then, analysis of variance (ANOVA) was performed for the data sets of all the reservoirs for a particular species. The null hypothesis was that the mean CPUEs of all the reservoirs were the same. If the ANOVA result supported the null hypothesis, then no further testing was necessary; otherwise, the next step was to determine which pair of reservoirs had different mean CPUEs. It was concluded that for each species, the null hypothesis was rejected at the 95% confidence level.

The Tukey-Kramer method (Neter et al., 1990) was used for multiple comparisons of pairs of reservoirs. With this method, for each species, the pairs of reservoirs with different mean CPUEs at the 95% confidence level were identified.

Results of this analysis are shown in Table 5. There appears to be broad similarities in the indicator species between reservoirs. These results are in general agreement with the catch rates of black bass, sunfish, and shad illustrated in Figure 1. Fairfield Reservoir, which is considered "average" among the reservoirs, shares the most similarities in the fish community, followed by Monticello Reservoir and Squaw Creek Reservoir. If black bass, sunfish, and shad are used as a measure of similarity, as shown below, there are significant similarities between all of the reservoirs and at least one of the representative reservoirs (see Table 5). Reservoirs that are significantly similar based on two of the three species are denoted with an asterisk.

Fairfield	Monticello	Squaw Creek
Colorado City	Fairfield	North
Martin Creek	Tradinghouse Creek	Colorado City
Monticello	Martin Creek	Granbury
Striker	Eagle Mountain	Striker*
North	Ray Hubbard	Tradinghouse*
Tradinghouse Creek	Graham	Martin Creek*
Graham	Colorado City*	Graham*
Ray Hubbard	Striker*	Ray Hubbard*
Eagle Mountain*	Granbury*	
Granbury*		

3.2.3 Analysis of Older Data

Cove rotenone data were available for most reservoirs (Table 3). The species were grouped similarly to the above. The data were mostly from the mid 1980s and probably do not represent current conditions due to reservoir aging and habitat dynamics, changes in trophic state, and changes in fisheries management. However, these data provide the only estimates of standing crop, which could be one of the most meaningful measures for comparing reservoirs and estimating impingement. In theory, catch rates of electrofishing, gill netting, and trap netting should be positively correlated with standing crop. That is, reservoirs with more target fish should yield larger electrofishing, gill net, and trap net sample sizes. Unfortunately, there is little to no overlap between estimates of standing crop and the sample techniques

currently employed to determine whether this is indeed the case. However, the relationships between the latest available cove rotenone data and mean electrofishing CPUE for various species were investigated. As shown on Figure 3, there appears to be no relationship between recent electrofishing catch rates and previous standing crop. Figures 3c and 3d compare total numbers and standing crop with the electrofishing survey closest to that period. In two cases, the electrofishing surveys were conducted during the same year of the cove rotenone survey, but in most cases there were at least 2 years difference between sample events. Assuming enough reservoirs were concurrently sampled using both techniques, a relationship between electrofishing catch rate and standing crop might be expected. However, due to the wide disparities between survey events and the age of the data, it appears that the existing standing crop estimates cannot be confidently applied for comparisons of these reservoirs under current conditions.

3.2.4 Habitat Analysis

Comparisons of fish habitat can provide a measure of reservoir similarities, but would largely be an indirect measure of fish community characteristics. It has been well documented that physical habitats such as aquatic plants, flooded terrestrial vegetation, and rocks are an important life requisite for the sunfish, black bass crappie, and channel catfish. The importance of these variables are summarized in the Habitat Suitability Index Models developed by the U.S. Fish and Wildlife Service (FWS) (Robison and Buchanan, 1992; Miller, 1987; FWS, 1982a; FWS, 1982b; FWS, 1982c; FWS 1982d). As such, the quality and quantity of available habitats can be a good predictor of the type of fish community a reservoir can support.

Recent habitat data were available for all of the reservoirs open or recently open to the public. However, the methods for measuring and recording habitats vary between reservoirs. For instance, the number of habitat fields for reservoirs ranged from 4 to 23. In some instances, habitat surveys were confined to the shoreline, whereas in other reports, open-water habitats were documented separately. Some subjectivity was required to enable some type of comparative analysis. A suite of habitat categories was developed and are shown in Table 4. These categories were further distilled into even broader habitat categories, which include aquatic vegetation coverage, brush/trees, rock/gravel (including rip-rap), boat docks/piers, and non-descript. To help normalize data between reservoirs, the shoreline percent coverage and open-water percent coverage was averaged to develop a mean for each habitat category. The abundance of each of the habitats for each reservoir are shown on Figure 4. Squaw Creek Reservoir has the highest percentage of all habitats combined due to the high abundance of rocks/gravel and submerged trees/brush. Monticello Reservoir had the highest percent coverage of aquatic vegetation. However, up until about 2001, Martin Creek Reservoir probably had the highest percent of aquatic vegetation coverage due to the invasion of hydrilla (*Hydrilla verticillata*), which was recently, in part, eliminated by low water levels and the introduction of grass carp (*Ctenopharyngodon idella*).

The relationship between black bass, sunfish, and shad and each of the habitat categories, including a total of the habitats, was developed and is illustrated on Figure 5. A regression line was plotted and the

proportion of the variance is expressed as R2 in each of the charts. A P-test was applied at the 95% (0.05) level to determine whether the relationships were significant. In all cases but two, there were no significant relationships between the electrofishing catch rates and the habitat categories. However, the relationship between sunfish and black bass electrofishing catch rates and percent total aquatic vegetation appears to be significant. Shad catch rates were not expected to be correlated with the cover types, although the studies suggest some dependence of these species on inundated vegetation for spawning (FWS, 1985; Robison and Buchanan, 1992). Since shad feed primarily on plankton, abundance of these species is probably more closely related to the fertility (trophic state) of the reservoirs.

These results do not come as a big surprise. It is well known that the relationship between aquatic vegetation and sunfish (including black bass) is usually positively correlated. However, due to the amount of error introduced by variations in sampling techniques and by lumping the habitat types together, there is a possibility that these relationships are a false positives and some of the others might be false negatives. In addition, the habitat categories were based on a one-time sample event. It is possible that the habitat surveys at this time were not representative of the normal habitat conditions in the reservoir due to differences in water levels and weather. However, normalizing the habitat data was not possible because only limited habitat data were available. Statistical comparisons between each reservoir and habitat coverage was not possible since only one survey (data point) was available for most reservoirs.

What comes as a surprise was the slight negative relationship between rocks/gravel and electrofishing catch-rates for sunfish, although not significant. However, part of this is explained by the high numbers of sunfish in Monticello Reservoir where practically no gravel or rocks are present. Instead, sunfish abundance in that reservoir was probably more closely tied to the abundance of aquatic vegetation. Although sunfish catch rates in Squaw Creek Reservoir were very low this reservoir has the highest composition of rock and gravel. As previously mentioned, electrofishing data from this reservoir might not be truly reflective of the population due to the high conductivity clear water and steep slope.

The apparent lack of relationships is generally inconsistent with what is known about cover-dependent species. However, with the available data it is difficult to support grouping the reservoirs based on habitat similarities or dissimilarities. The exception to this is aquatic vegetation. When comparing black bass and sunfish populations in reservoirs, the data indicate that aquatic vegetation should be considered. The ±25% error range was arbitrarily selected since statistical analysis were not possible. If we take the similarities in aquatic vegetation coverage, while assuming this sample error, the following reservoirs can be grouped together.

Monticello	Fairfield	Squaw Creek
Tradinghouse	Tradinghouse	Eagle Mountain
	Ray Hubbard	Martin Creek
	North	Colorado City
	Striker	Granbury

Graham Reservoir is the only reservoir that did not fall into the ±25% range of any of the representative reservoir. However, this is somewhat of a broad grouping since the error range was arbitrarily selected. Due to the weaknesses of these comparisons and since habitats provide an indirect measure of fish populations, grouping reservoirs based on habitats should be secondary to grouping the reservoirs based on the fish communities.

3.2.5 Reservoir Physical Characteristics

Physical characteristics of this set of reservoirs vary widely based on their sizes, depths, stream order of the impounded stream, shoreline development ratio (SDR), and their location in relation to the state's vegetative regions (a characterization of the vegetative regions can be found in Gould [1962]). Reservoir size and their source waters probably account for some of the variations in fish populations, such as the abundance of white bass and crappie in the main-stem reservoirs. Fish species distribution can also vary from one region to the next, but with a few exceptions, that pattern generally applies to natural surface waters. Species composition probably varies with longitude in these reservoirs, but this type of analysis could not be performed due to scarcity of non-game species accounts. Instead, the data indicate that species composition between reservoirs is largely homogenous, at least for species targeted by fisheries management. In addition, catch rates of representative species across ecoregions and latitude were assessed, but did not demonstrate any type of correlation. This can be seen on Figure 2, where catch rates of the indicator species is independent of the location of the reservoir.

Catch rates of the indicator species were also independent of reservoir size. Although each analysis is not presented in this document, an example is presented on Figure 6a where sunfish catch rates were independent of reservoir size. Monticello Reservoir, which is one of the smallest reservoirs, had the highest catch rates for sunfish. This is interesting because if the impacts of impingement are high due to these facilities, this would mean that Monticello Reservoir, which supports a base-loaded facility and is one of the smallest reservoirs, should have low catch rates of the indicator species. Instead, it appears to be the most productive of all of the reservoirs. This issue was not addressed in this study, but there appears to be little relationship between the facility to volume ratio and catch rates of indicator species.

Similar to reservoir size, SDRs were also independent of catch rates of indicator species. SDR is the ratio between the amount of shoreline length to open water. A higher SDR means there is a higher amount of shoreline to open water (an SDR of 1 is a circle or has the least amount of shoreline possible). An example of sunfish catch rate compared with the SDRs is provided in Figure 6b. While reservoir size and SDR might be good indicators of a reservoir's ability to support a larger population sizes or standing crop, they essentially have no relationship with sampling catch rates. Larger reservoir sizes and higher SDRs suggest that more fish might be available for impingement; however, with increasing reservoir size and SDR, the potential interaction between CWISs and fish is decreased due to increased distance.

4.0 RECOMMENDATIONS FOR RESERVOIR GROUPING

Based on available fisheries data, there is good support for using the reservoirs identified by TXU to represent potential impingement at the remaining facilities. It will also be important to consider the facility operations, withdrawal rates, and CWIS characteristics for estimating impingement mortality at the remaining facilities. Since TPWD data do not exist for Trinidad or Valley Lake reservoirs, and only older, standing crop data exist for Lake Creek, some judgment regarding their fisheries will be required to identify an appropriate representative reservoir. Anecdotal information from TXU staff indicate that these reservoirs share similarities with Fairfield Reservoir. In turn, this information can probably be supported by the broad similarities Fairfield Reservoir shares with other reservoirs in this study.

The following table shows the reservoirs that can be grouped using similarities in fisheries as the primary criteria and aquatic vegetation as secondary criteria. The order in which the reservoirs are listed generally reflects the order of similarity. Reservoirs are listed multiple times since they share significant statistical similarities with more than one representative reservoir.

Fairfield	Monticello	Squaw Creek
Colorado City	Fairfield	North
Martin Creek	Tradinghouse Creek	Colorado City
Monticello	Martin Creek	Granbury
Striker	Eagle Mountain	Striker
North	Ray Hubbard	Tradinghouse Creek
Tradinghouse Creek	Graham	Martin Creek
Graham	Colorado City	Graham
Ray Hubbard	Striker	Ray Hubbard
Eagle Mountain	Granbury	
Granbury		

The analysis of available physical and biological data for the reservoirs considered in this study support grouping similar reservoirs together based on recently collected fisheries data. There were significant similarities between the catch rates of many of the common species targeted by fisheries managers and various reservoirs, which allowed for reasonable reservoir grouping by fisheries. From these data and anecdotal information about impingement in Texas reservoirs, it was concluded that sunfish and shad are among the species most common to these reservoirs and are likely to represent a majority of impingement numbers. The data also support that black bass are ubiquitous and relatively abundant, but this species is probably less prone to impingement because it remains of size susceptible to impingement only for a short period of its life. This is probably the case for many other species that attain larger sizes. As such, black bass, sunfish, and shad together are good indicators of reservoir health and are good candidates for measuring impingement.

Crappie, temperate bass, and catfish are also popular sport fish, but the sampling techniques preclude statistical analysis of the early life stages of these species, which would be the age group more susceptible to impingement. Catfish catch rates are among the highest in the representative reservoirs and would be well represented by these reservoirs. Only a few reservoir support substantial catch rates of crappie and temperate bass. Among these, Ray Hubbard Reservoir has relatively high catch rates of both groups of these fish. Since these species are not represented well in the representative reservoirs, it might be possible to conduct verification monitoring shortly after their reproductive season (late spring) to determine whether these species are susceptible to impingement. Considering the infrequent and unpredictable operation of this facility, sampling of this facility might not be practicable or possible for meeting quality assurance requirements.

Aside from the situation with crappie and white bass, measurements of habitats, locations, and physical characteristics of reservoirs appeared to have little bearing on catch rates of the indicator species. However, there was a positive relationship between aquatic vegetation and catch rates of sunfish and black bass, which is worth considering. The reservoirs that demonstrated a significant relationships based on aquatic plant abundance were in line with the reservoir grouping established based on the fisheries.

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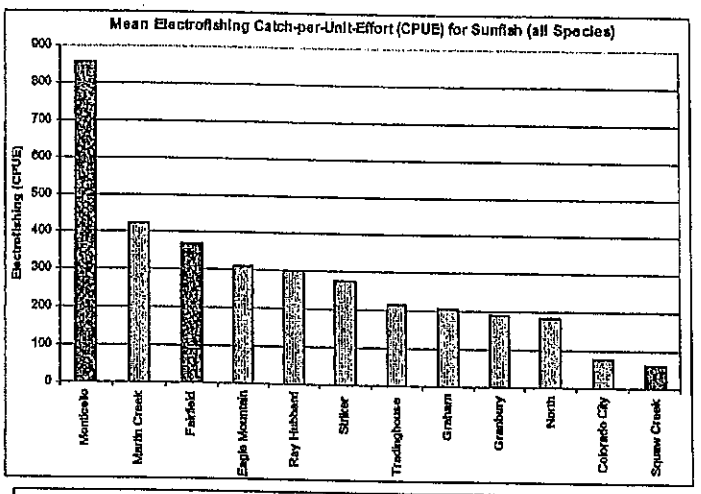
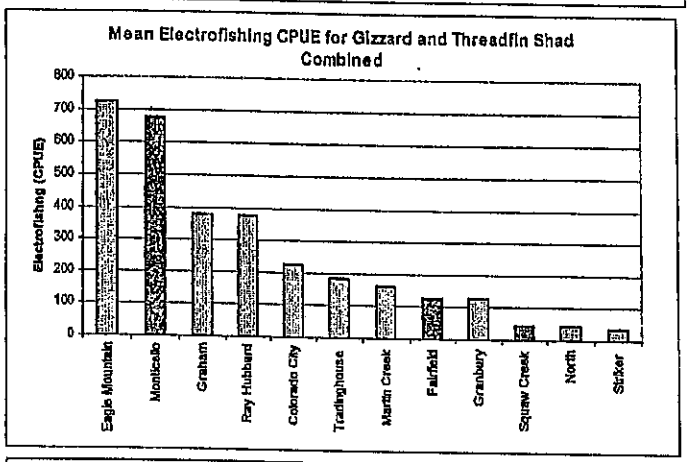
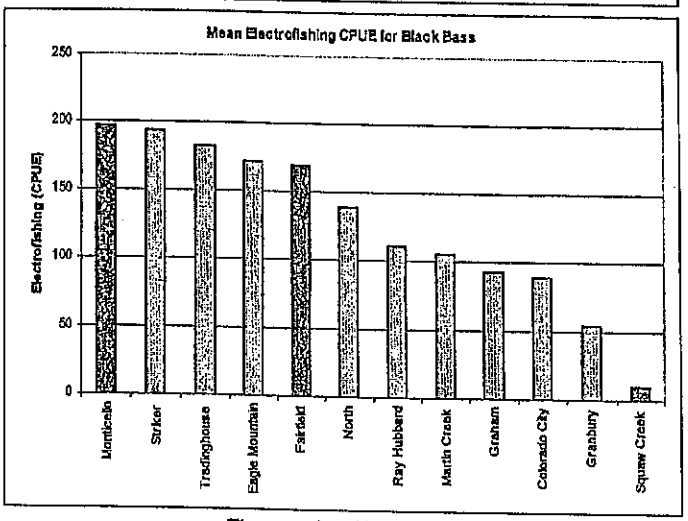
Figure 1: Mean Electrofishing CPUE for the Indicator Species, Sunfish, Shad, and Black Bass



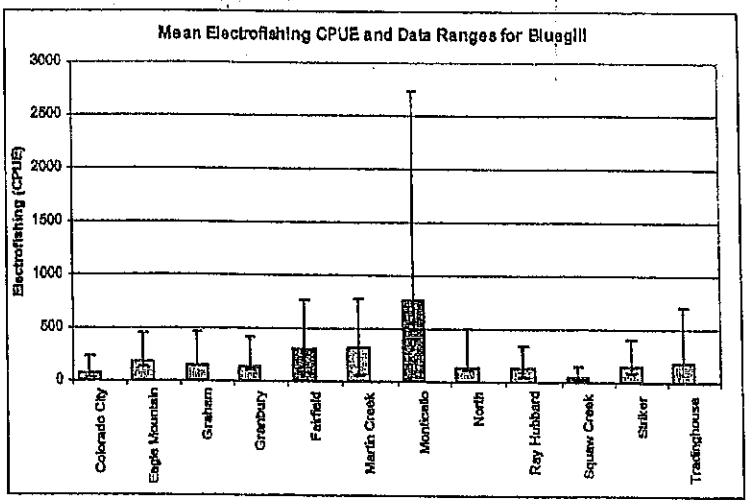


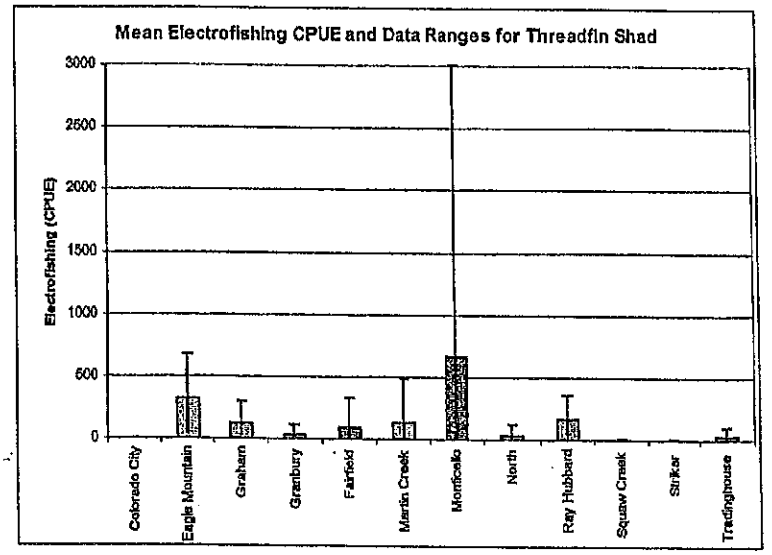


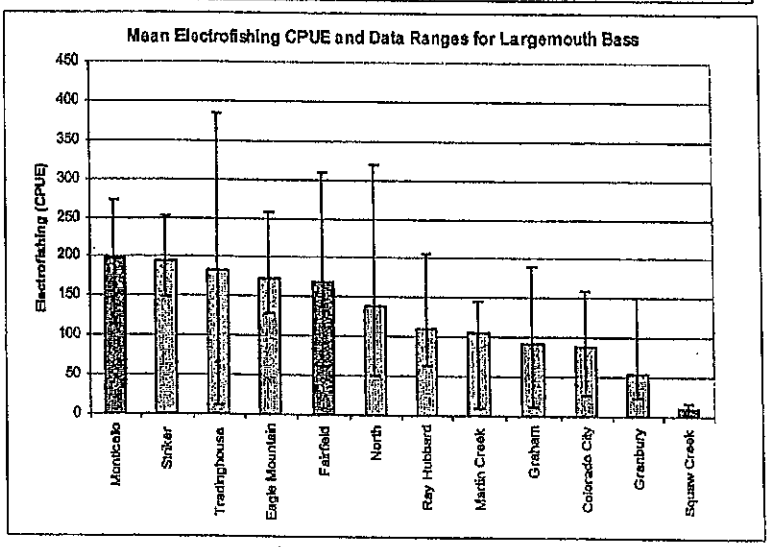
Figures 1a, 1b, and 1c

Representative reservoirs are shaded in dark gray.
Source: TPWD performance reports.

Figure 2: Mean Electrofishing and Data Ranges for Selected Species



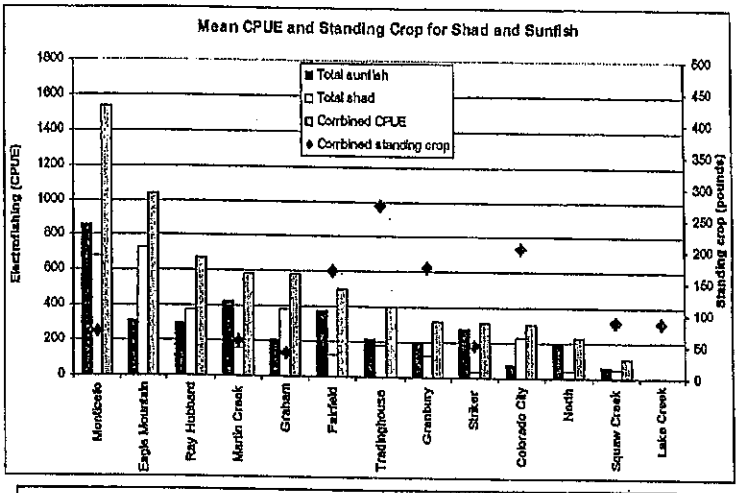


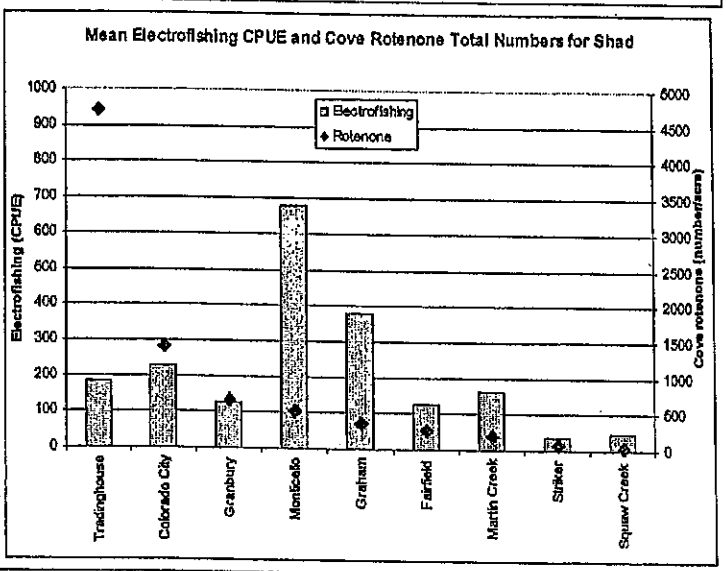


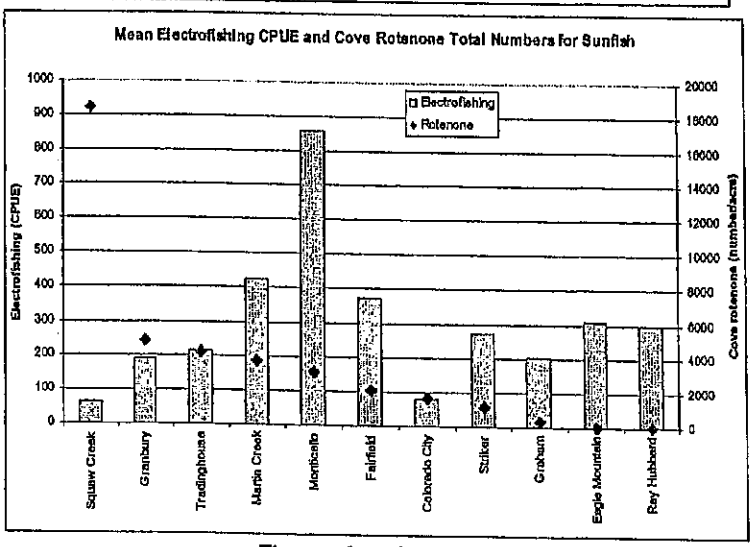
Figures 2a, 2b, and 2c

Error bars represent data ranges. Representative reservoirs are shaded in dark gray.
Source: TPWD performance reports.

Figure 3: Comparison Between Mean Electrofishing CPE and Cove Rotenone Data for Various Species

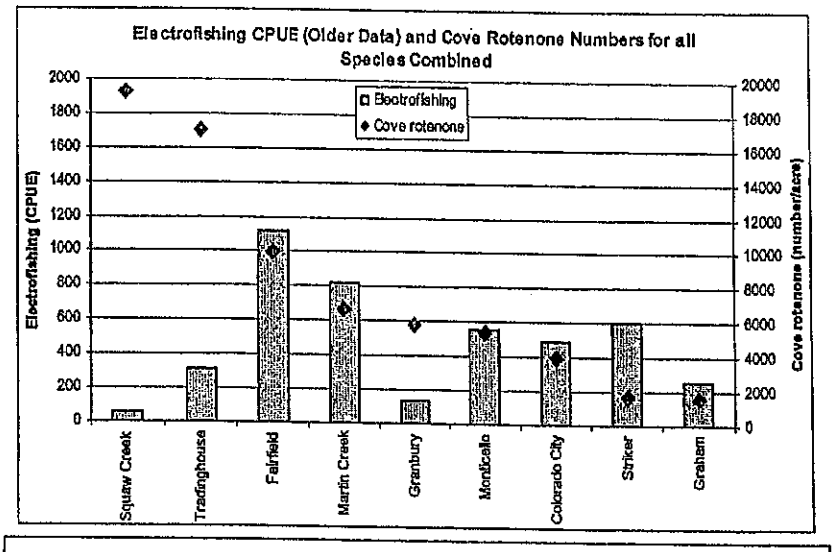


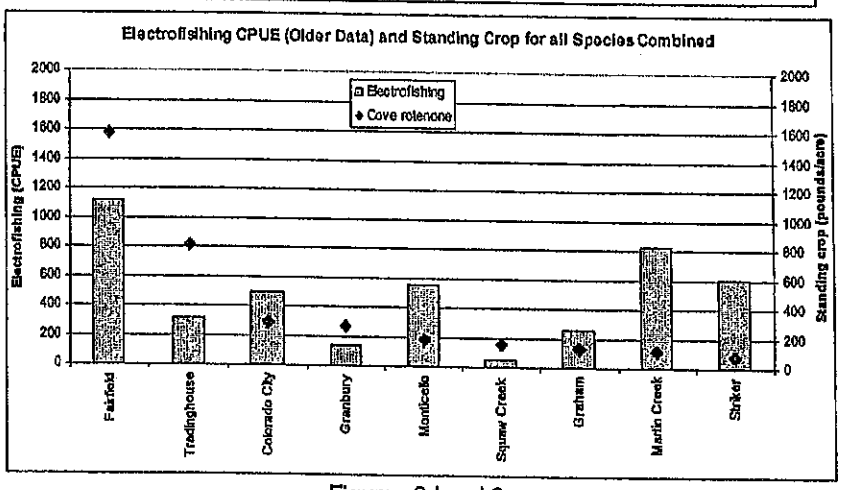




Figures 3a, 3b, and 3c

Figure 3 (Cont'd)





Figures 3d and 3e

Source: TPWD performance reports.

Figure 4: Percent Coverage of Selected Habitats by Reservoir

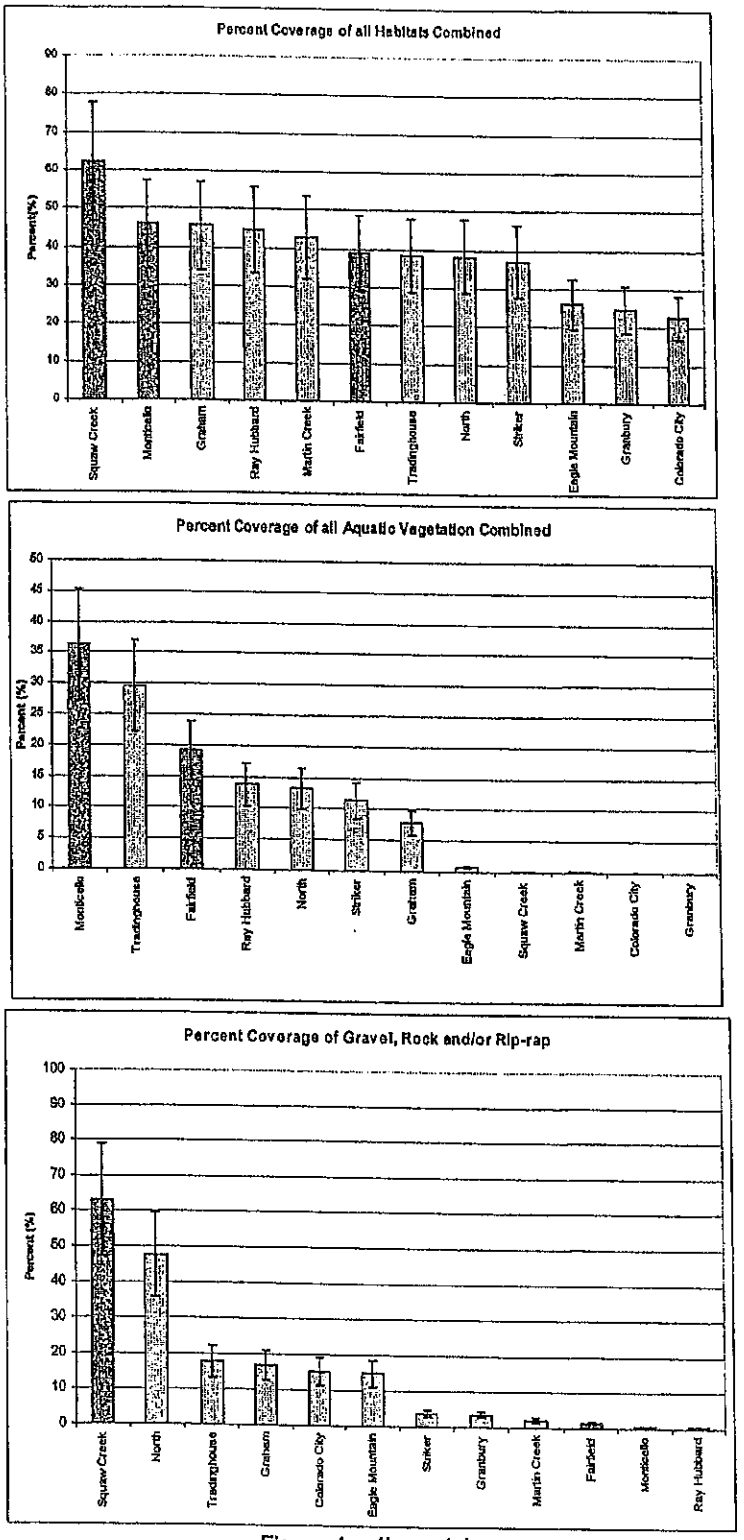
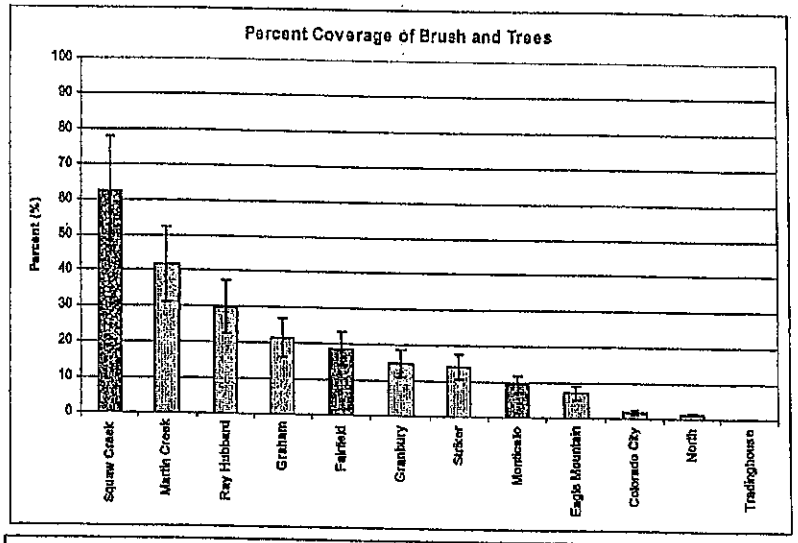


Figure 4a, 4b, and 4c

Figure 4 (Cont'd)



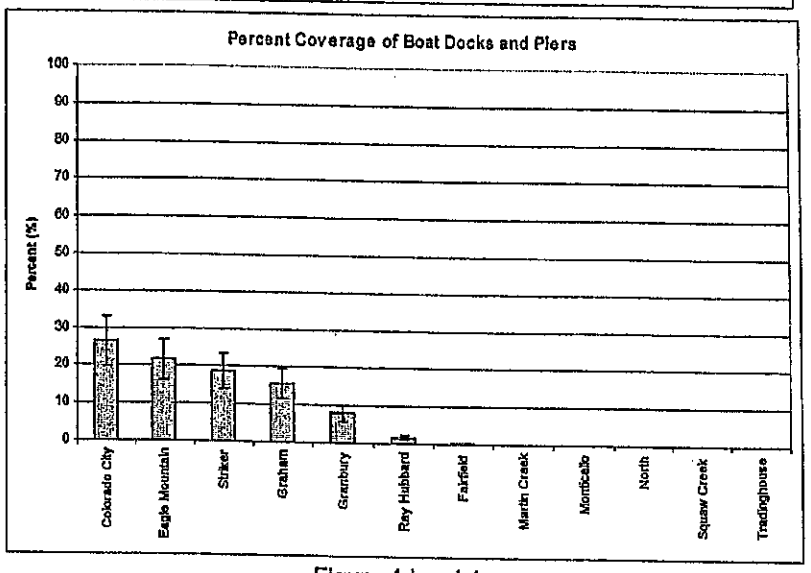
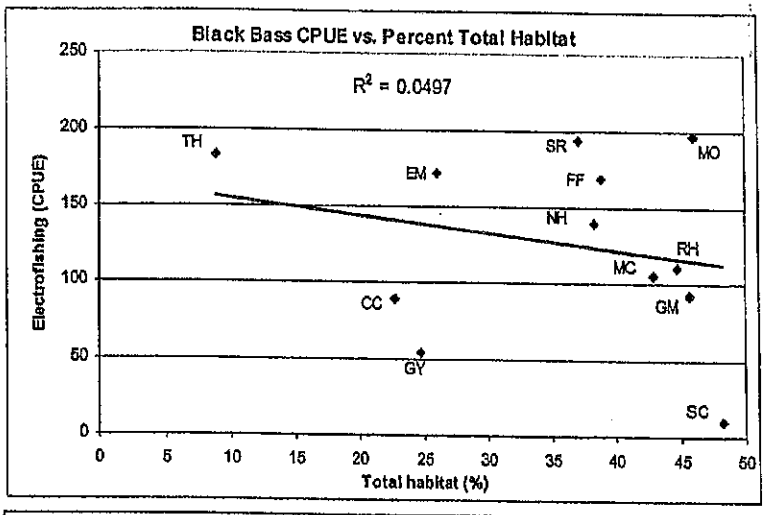
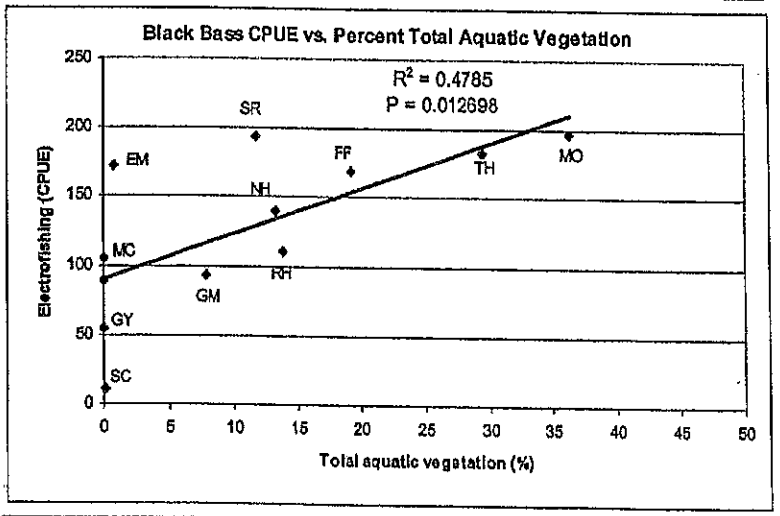


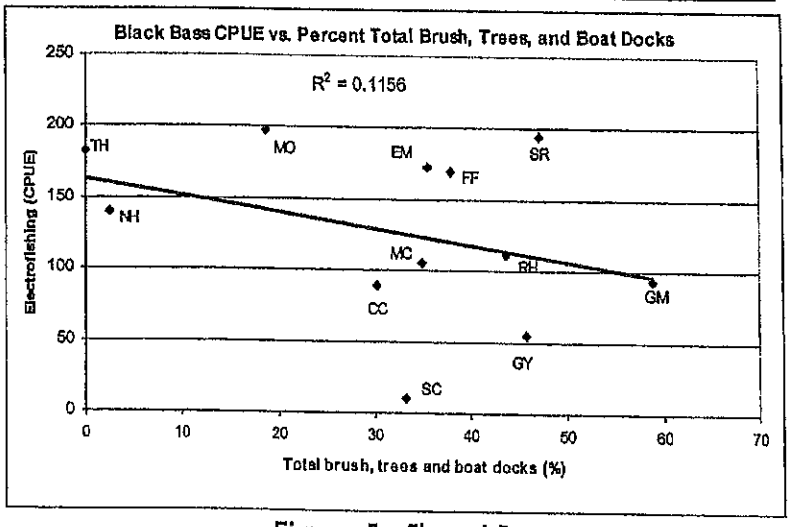
Figure 4d and 4e

Error bars indicate ±25% error.
Source: TPWD performance reports.

Figure 5: Relationship Between Sampling Catch Rates of Selected Species and Various Habitat Types

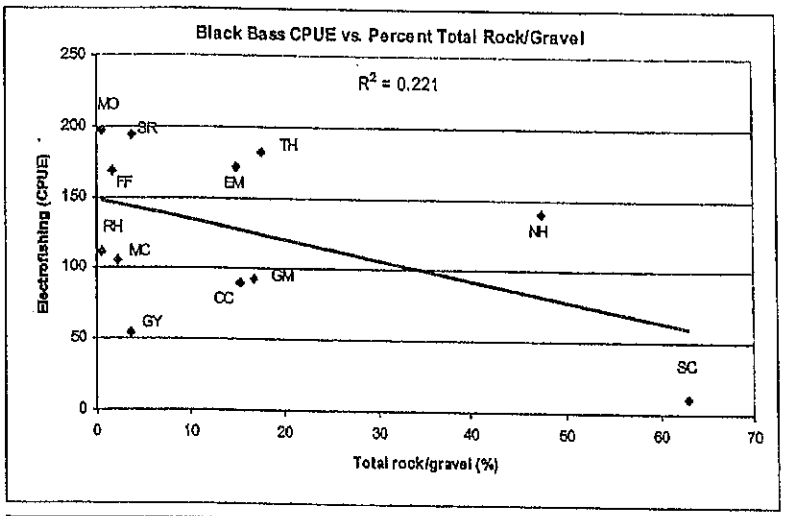


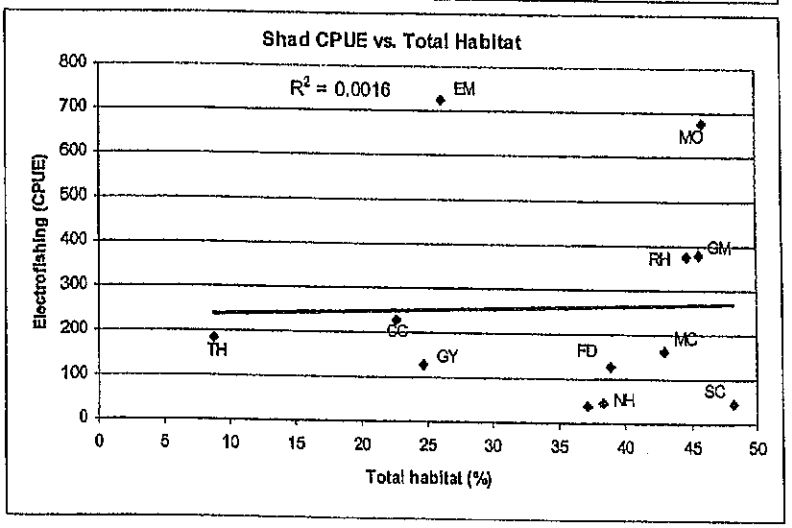


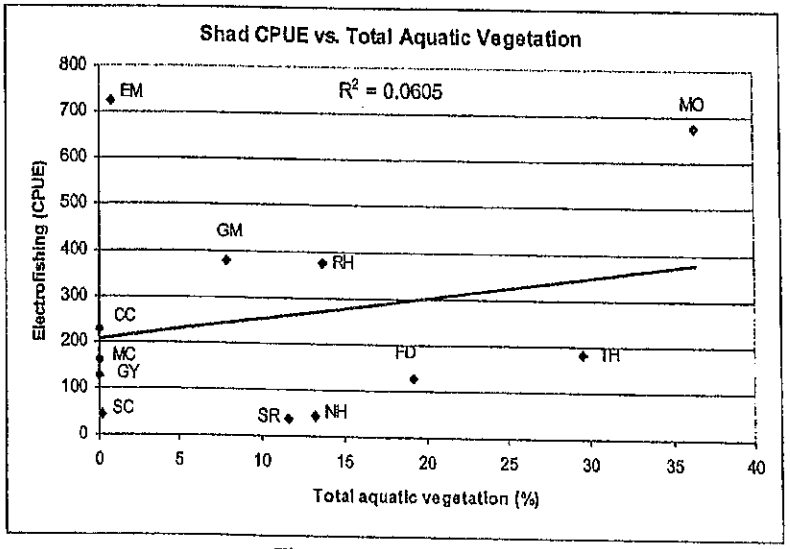


Figures 5a, 5b, and 5c

Figure 5 (Cont'd)

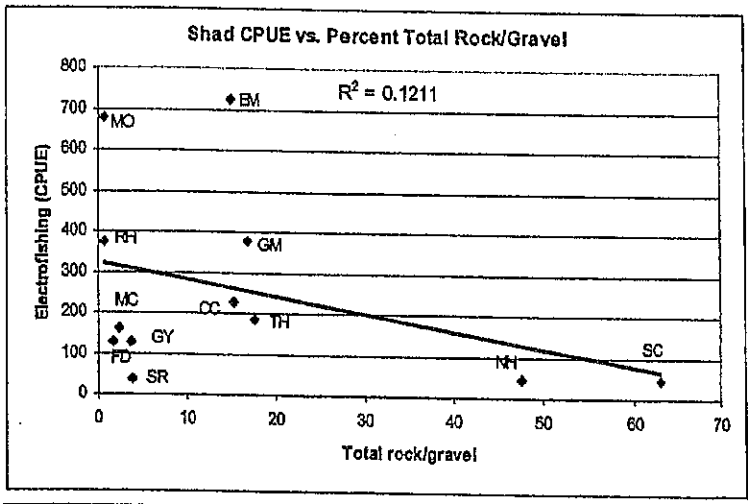


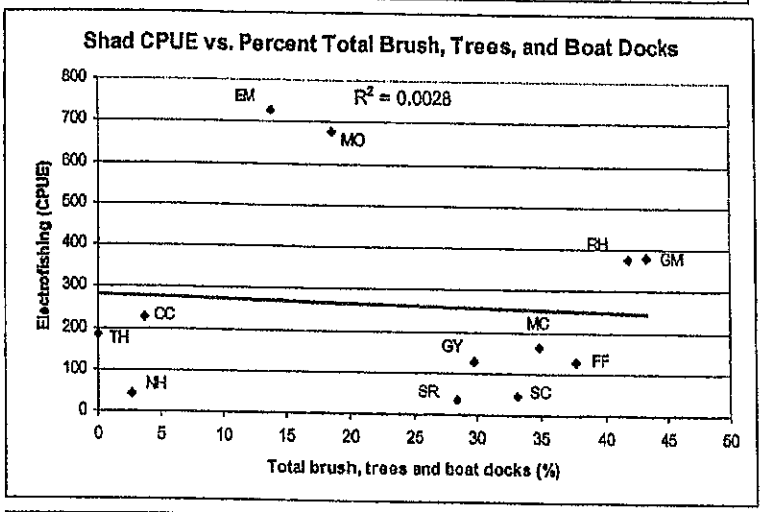


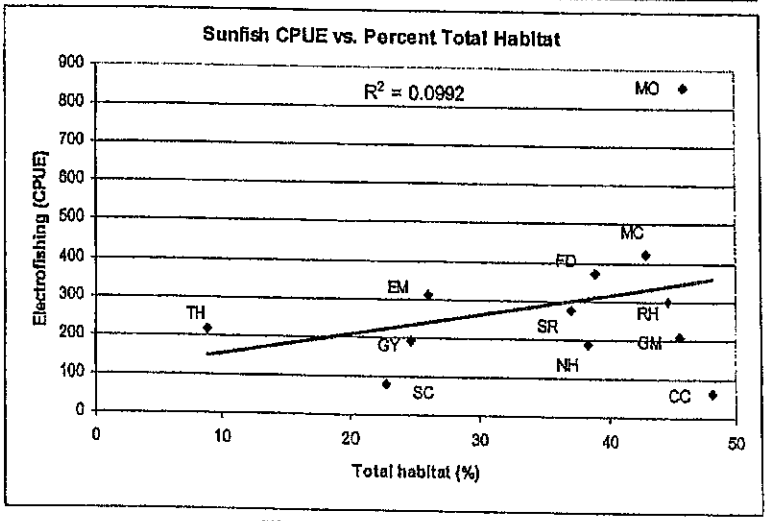


Figures 5d, 5e, and 5f

Figure 5 (Cont'd)

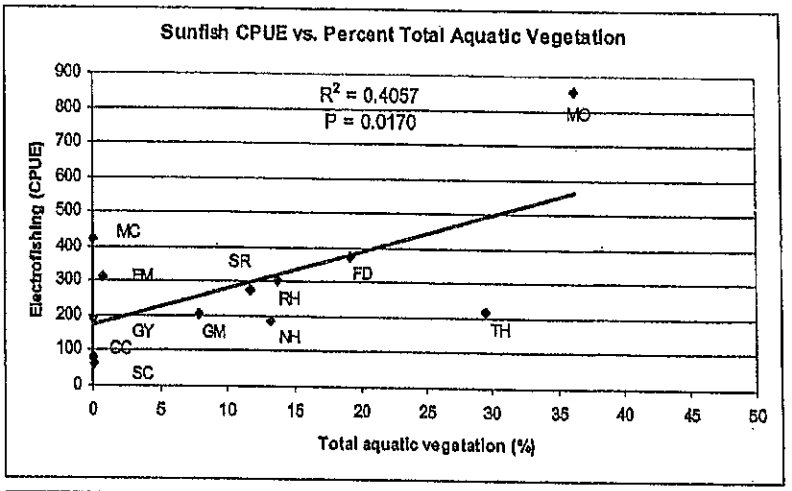


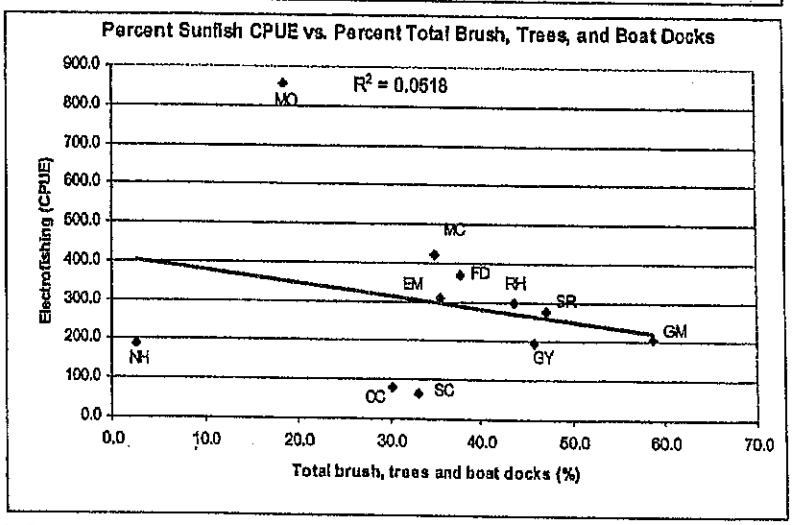


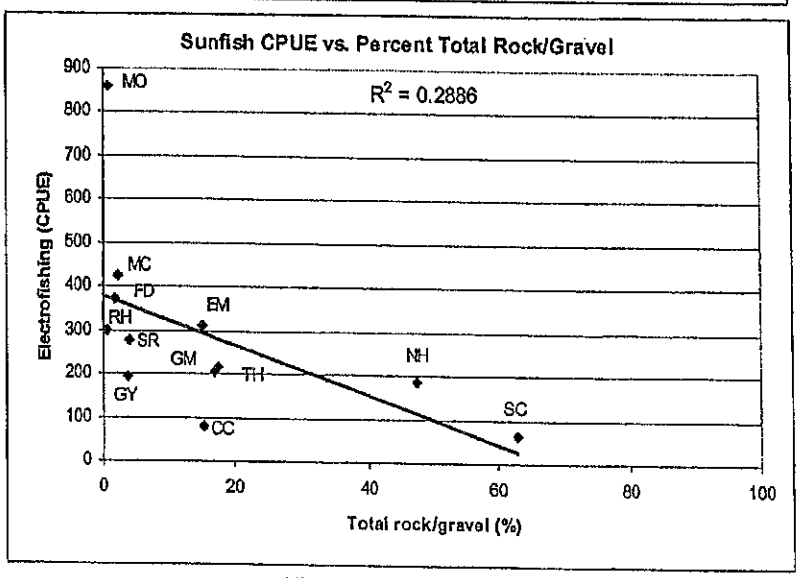


Figures 5g, 5h, and 5i

Figure 5 (Cont'd)



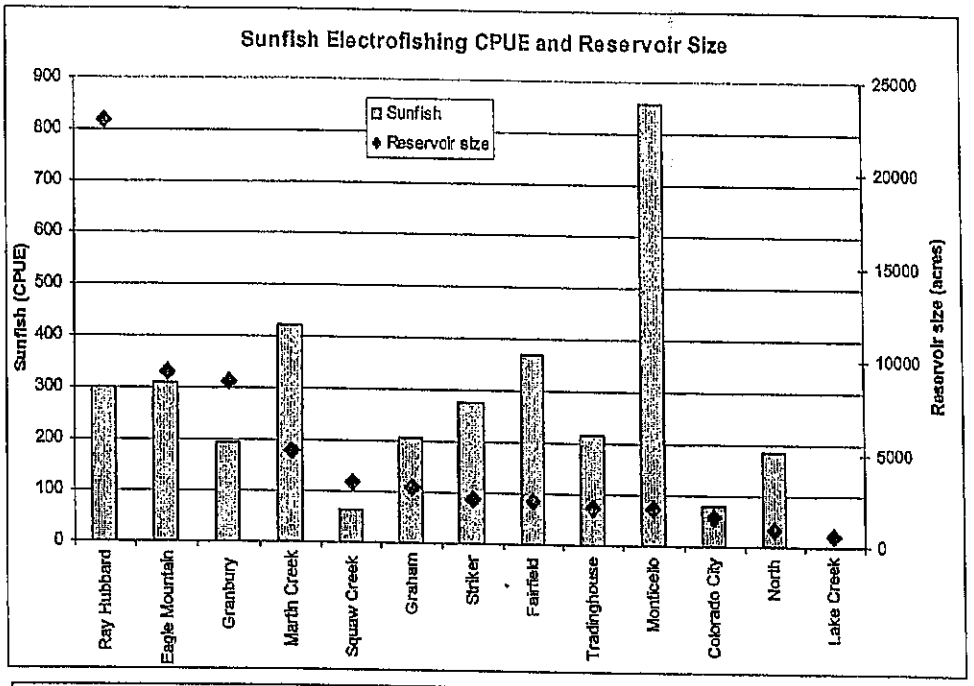


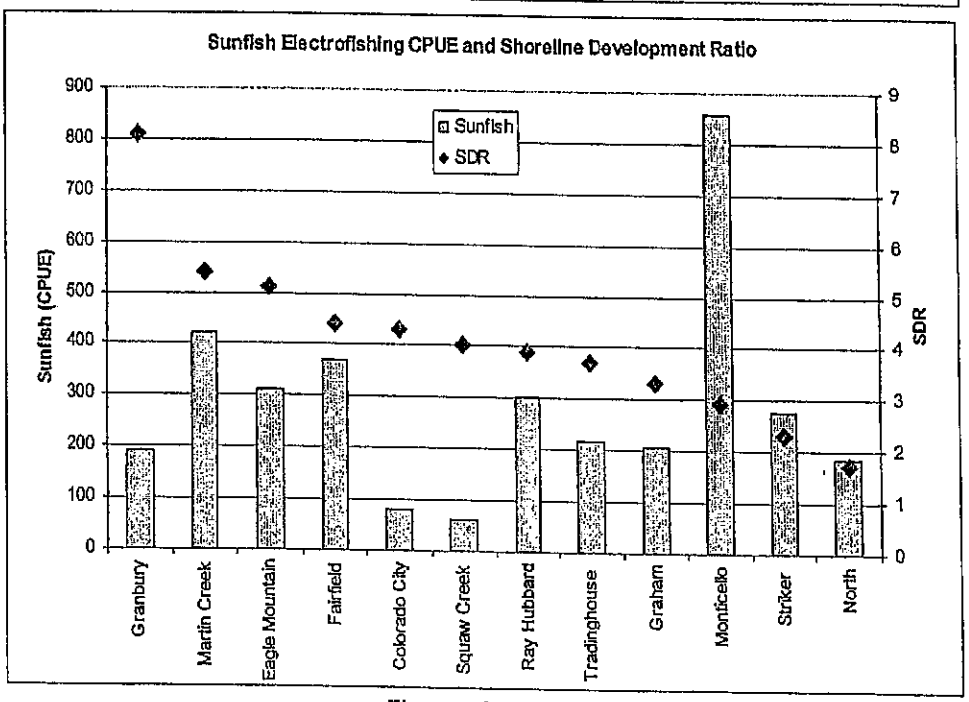


Figures 5j, 5k, and 5l

Source: TPWD performance reports.

Figure 6: Relationship Between Reservoir Sizes and Shoreline Development Ratios (SDR) and Sunfish Electrofishing Catch Rates





Figures 6a and 6b

Source: TPWD performance reports.

TABLE 1
RESERVOIR PHYSICAL CHARACTERISTICS

Reservoir	Report year	Size (acres)	Size (square feet)	Mean Secchi Depth (feet)	Mean Depth (feet)	Max Depth (feet)	Conductivity (mho/cm)	Shoreline Length (miles)	Shoreline Length (feet)	Shoreline Development Ratio	River System	Year Built	Controlling Authority	County (dam)
Colorado City	2001	1618	70480080	3.0	12.0	51.0	360	24.0	126720	4.3	Colorado	1949	TBD	Mitchell
Eagle Mountain	2000	9200	400752000	3.0	22.0	47.0	230	69.0	364320	5.1	Trinity	1954	Tarrant County Water Control and Improvement District No.1	Tarrant
Graham	2001	3000	130680000	1.0	21.0	45.0	450	25.0	132000	3.3	Brazos	1929	City of Graham	Young
Granbury	2001	8700	378972000	4.0	18.0	75.0	2400	106.0	559680	8.1	Brazos	1969	Brazos River Authority	Hood
Fairfield	2000	2353	102496680	5.0	21.5	50.0	850	30.0	158400	4.4	Trinity	1969	TBD	Freestone
Lake Creek	1985	616	26832960	no data	14.4	35.0	no data	7.5	39487	2.2	Brazos	1951	TBD	McLennan
Martin Creek	2001	5000	217800000	2.5	16.0	50.0	120	53.0	279840	5.4	Sabine	1974	TBD	Rusk
Monticello	1999	2000	87120000	3.8	20.3	40.0	335	18.0	95040	2.9	Cypress	1972	TBD	Titus
North	1998	907	39508920	5.0	20.0	55.0	300	7.5	37725	1.7	Trinity	1957	TBD	Dallas
Ray Hubbard	2001	22745	990772200	3.0	21.5	40.0	200	83.0	438240	3.9	Trinity	1968	City of Dallas	Rockwall
Squaw Creek	1997	3272	142528320	5.0	46.0	135.0	1300	32.0	168960	4.0	Brazos	1979	TBD	Hood, Somerville
Striker	1999	2400	104544000	2.0	15.0	35.0	200	16.0	84480	2.3	Angelina		Angelina Nacogdoches County Water Control and Improvement District	Rusk
River Crest*													TBD	Red River
Tradinghouse	2000	2012	87642720	3.0	19.0	42.0	1200	23.0	121440	3.7	Brazos	1968	TBD	McLennan

*Announced for retirement and will not be considered for 316(b) compliance.

Source: TPWD Reservoir performance reports.

TABLE 2
FISHERIES SURVEY DATA FOR SELECTED SPECIES BY RESERVOIR

Black Bass Electrofishing CPUE																			
	Largemouth bass																		
Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
Colorado City			159.0			27.0			77.0	79.0		89.3				104.0			89.2
Eagle Mountain			173.0	121.0	110.0	119.0	222.7			150.0			93.3		105.3				136.8
Graham	23.3				12.0				90.0			149.3				188.8			92.7
Granbury			10.0		7.3		14.7			57.3			83.3			60.0			38.8
Fairfield		76.6	61.3			310.0		94.0			192.0			242.0	205.0				168.7
Martin Creek						120.7			154.0					146.0	9.4	96.7			105.4
Monticello				169.3	208.0	195.0	172.0	238.7	246.7	271.3	213.3	122.4	112.7	202.0					195.6
North			79.0			37.0	306.0			94.0			113.0						125.8
Ray Hubbard				88.0		63.0			101.0			206.5			96.0				110.9
Squaw Creek			10.7		2.0				12.7			16.0							10.4
Striker			127.3			70.7	55.3	56.0		43.3	51.3			80.0				24.0	69.1
Tradinghouse				59.3		11.1			384.0			181.0			277.0				182.5

	Spotted bass																		Total
Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean	Mean
Colorado City			0.0			0.0			0.0	0.0		0.0				0.0			0.0	89.2
Eagle Mountain			25.0		21.0		55.0			48.0			42.0		18.7				35.0	171.7
Graham	0.0				0.0				0.0			0.0				0.0			0.0	92.7
Granbury			6.7		4.0		8.0			14.7			35.3						15.5	54.3
Fairfield		0.0	0.0			0.0		0.0			0.0			0.0	0.0				0.0	168.7
Martin Creek						0.0			0.0					0.0	0.0	0.0			0.0	105.4
Monticello				2.0	3.3	0.0	2.0	0.7	1.3	0.7	2.7	1.6	0.0	1.0					1.3	196.9
North			6.0			6.0	16.0			27.0			5.0						13.5	139.3
Ray Hubbard				0.0		0.0			0.0			0.0			0.0				0.0	110.9
Squaw Creek			0.0		0.0					0.0		0.0							0.0	10.4
Striker			108.7			111.3	132.7	171.3		72.7	258.0			77.0				66.0	124.7	193.8
Tradinghouse												0.0			0.0				0.0	182.5

Empty Cells Indicate that there was no survey for that year. CPUE = Catch Per Unit Effort.
Source: TPWD Reservoir performance reports.

TABLE 2 (Cont'd)

Shad Electrofishing CPUE																			
	Gizzard shad																		
Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
Colorado City			141.0			77.0			121.5			410.0			380.0				225.9
Eagle Mountain			214.0		291.0		329.0			274.0			589.3		711.8				401.5
Graham	48.7				84.7				261.3			202.7				694.0			258.3
Granbury			49.3		55.3		122.7			175.3			84.7			102.7			98.3
Fairfield		26.7	5.4			26.0		28.0			56.7			18.0	60.0				31.5
Martin Creek						43.3			14.7					55.3	11.3	12.7			27.5
Monticello				0.7	0.0	1.0	0.7	2.0	30.7	28.0	21.3	14.4	22.0	2.0					11.2
North			16.0			1.0	15.0			24.0			30.0						17.2
Ray Hubbard				163.0		78.0			309.0			299.5			177.5				205.4
Squaw Creek			10.0		6.0				7.3			152.0							43.8
Striker			24.7			26.7	25.3	32.0			30.0			38.0				64.0	34.4
Tradinghouse				32.7		4.0			148.0			121.0			441.0				149.3

	Threadfin shad																			Total
Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean	Mean
Colorado City			0.0			0.0			0.0			0.0			3.0				0.6	226.5
Eagle Mountain			387.0		37.0		155.0			115.3			579.3		670.0				323.9	725.5
Graham	60.7				113.3				31.3			304.0				88.8			119.6	377.9
Granbury			0.0		110.0		36.0			5.3			4.0			14.7			28.3	126.7
Fairfield		25.3	332.0			100.0		6.0						21.0		89.0			95.6	127.1
Martin Creek						29.3			7.3					86.7	490.0	60.0			134.7	162.1
Monticello				239.3	615.3	1,040.0	1,007.3	3,010.0	143.3	267.3	401.3	230.4	5.3	370.0					666.3	677.5
North			4.0			0.0	2.0			1.0			126.0						26.6	43.8
Ray Hubbard				170.0		41.0			174.0			100.0			359.5				168.9	374.3
Squaw Creek			0.0		0.7				6.0			0.0							1.7	45.5
Striker			3.3			4.0	0.0	0.7						0.0				7.0	2.5	36.9
Tradinghouse				36.0		5.0			24.8			101.0			3.0				34.0	183.3

Empty Cells Indicate that there was no survey for that year. CPUE = Catch Per Unit Effort.
Source: TPWD Reservoir performance reports.

TABLE 2 (Cont'd)

Sunfish Electrofishing CPUE

Reservoir	Bluegill																		
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
Colorado City			158.0			30.0			61.4			50.7			46.0				69.2
Eagle Mountain			273.0		212.0		276.0			132.0			47.3		140.0				180.1
Graham	1.3				14.0				56.3			316.7				324.0			142.5
Granbury			33.3		27.3		52.7			283.3			239.3			194.7			138.4
Fairfield		220.0	234.7			412.0		283.0			227.3			329.0	459.0				309.3
Martin Creek						286.7			312.7					464.0	258.7	284.7			321.4
Monticello				330.7	541.3	1126.0	428.0	353.3	388.0	271.3	1950.7	856.8	1410.6	874.0					775.5
North			148.0			375.0	24.0			88.0			26.0						132.2
Ray Hubbard				80.0		211.0			80.6			179.0			96.0				129.3
Squaw Creek			20.7		15.3				45.3			101.0							45.6
Striker			158.8			152.7	130.0	88.7			106.7			259.0				65.0	149.3
Tradinghouse				29.3		8.0			181.6						528.0				186.7

Reservoir	Other sunfish (not including bluegill)																			Total Mean
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean	
Colorado City			28.0			5.0			5.0						3.0				10.3	79.5
Eagle Mountain			192.0		173.0		92.0			116.7			54.7		152.7				130.2	310.2
Graham	4.7				6.7				36.3			94.7				175.2			63.5	206.0
Granbury			14.7		9.3		40.0			69.9			109.4			81.3			54.1	192.5
Fairfield		13.3	0.7			98.0		211.3			6.7			53.0	45.0				61.1	370.4
Martin Creek						102.6			131.4					105.3	34.7	131.3			101.1	422.4
Monticello				108.0	216.0	272.0	80.0	66.7	63.3	35.3	9.3	15.2	19.3	10.0					81.4	856.9
North			73.0			63.0	47.0			47.0			35.0						53.0	185.2
Ray Hubbard				212.0		281.0			45.5			263.5			52.0				170.8	300.1
Squaw Creek			10.7		24.7				4.6			29.0							17.3	62.8
Striker			136.0			194.0	177.3	43.3						78.0				62.0	125.7	275.0
Tradinghouse				8.7		1.5			28.0						80.0				29.6	216.3

Empty Cells indicate that there was no survey for that year. CPUE = Catch Per Unit Effort.
Source: TPWD Reservoir performance reports.

TABLE 2 (Cont'd)

Catfish Gill Net CPUE																			
	Blue catfish																		
Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
Colorado City			0.0			0.8			0.0			0.2				0.4			0.3
Eagle Mountain							0.0			0.7			0.6			0.9			0.6
Graham	0.0	0.0			0.0				0.0			0.0					0.7		0.1
Granbury							0.0			0.2			0.0			0.2	0.0		0.1
Fairfield			0.0			0.0		0.0			0.0			0.0		0.0			0.0
Martin Creek									0.0			0.2					0.0		0.1
Monticello				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					0.0
North			0.0			0.0	0.0			0.0			0.0						0.0
Ray Hubbard				0.0		0.0			5.0			13.1				8.3			5.3
Squaw Creek			0.0		0.0				0.0			0.0							0.0
Striker			0.0			0.0		0.0			0.0			0.0				0.0	0.0
Tradinghouse				0.0		0.0			0.0		0.0			0.0	0.0	0.0			0.0

	Channel Catfish																			Total
Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean	Mean
Colorado City			9.0			2.8			1.6			1.2				1.6			3.2	3.5
Eagle Mountain			8.0		5.0		7.0			11.8			3.8			2.3			6.3	6.9
Graham	2.7	1.0			1.0				3.8			3.2					3.1		2.5	2.6
Granbury			5.0		3.7		4.4			4.9			3.9			5.5	5.0		4.6	4.7
Fairfield			15.5			7.2		0.8			2.6			7.0		17.4			8.4	8.4
Martin Creek						2.1			2.1			3.8					13.0		5.3	5.3
Monticello				43.4	20.2	25.8	22.8	14.2	24.4	0.0	20.6	14.6	20.2	13.8					20.0	20.0
North			2.0		0.0	2.0				1.4			2.6						1.6	1.6
Ray Hubbard				5.0		19.0			7.6			5.6				5.7			8.6	13.9
Squaw Creek			2.0		5.4				15.0			18.4							10.2	10.2
Striker			18.5			5.2		5.2			4.2			0.8				8.8	7.1	7.1
Tradinghouse				13.8		14.2			13.6		9.6			7.2	3.0	4.8			9.5	9.5

Empty Cells Indicate that there was no survey for that year. CPUE = Catch Per Unit Effort.
Source: TPWD Reservoir performance reports.

TABLE 2 (Cont'd)

Temperate Basses Gill Net CPUE

White bass

Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
Colorado City			7.8			0.8			1.4			16.8				30.0			11.4
Eagle Mountain			7.0		9.0		3.0			10.3			11.1			3.7			7.4
Graham		0.5	0.0		0.6				5.0			3.4					2.9		2.1
Granbury			9.5		8.5		0.7			4.1			2.3			1.9	2.3		4.2
Fairfield			0.0			0.0		0.0			0.0			0.0		0.0			0.0
Martin Creek						0.0			0.0			0.0					0.0		0.0
Monticello				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					0.0
North			3.0			0.0	4.0			3.2			0.6						2.2
Ray Hubbard				9.0		12.0			11.3			5.7				3.5			8.3
Squaw Creek			0.8		5.0				0.8			0.2							1.7
Striker			7.3			0.6		0.0		0.0	0.2			0.0				3.0	1.6
Tradinghouse				0.0		1.0			1.0			1.2		0.0	0.9	1.0			0.7

Striped bass

Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
Colorado City			0.0			0.0			0.0			0.0				0.0			0.0
Eagle Mountain			0.0		0.0		0.0			0.0			0.0			0.0			0.0
Graham			0.0		0.0				0.0			0.0				0.0			0.0
Granbury			2.0		0.7		2.3			1.9			1.7			0.4	1.9		1.6
Fairfield			0.0			0.0		0.0											0.0
Martin Creek						0.0			0.0			0.0					0.0		0.0
Monticello				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					0.0
North			0.0			0.0	0.0			0.0			0.0						0.0
Ray Hubbard				0.0		0.0			0.0			0.1				0.0			0.0
Squaw Creek			0.0		0.0				0.0			4.8							1.2
Striker			0.0			0.0		0.0		0.0	0.0			0.0				0.0	0.0
Tradinghouse				0.0		0.0			0.0			0.0		0.0	0.0	0.0			0.0

Palmetto bass (hybrid white male x striped female bass)

Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean	Total Mean
Colorado City			0.0			0.0			0.0			0.0				0.0			0.0	11.4
Eagle Mountain			0.0		0.0		0.0			0.0		0.0				0.0			0.0	7.4
Graham	0.2	0.2			4.6				9.0			10.0					2.7		4.5	6.5
Granbury			0.0		0.0		0.0			0.0			0.0			0.0	0.0		0.0	5.7
Fairfield			11.2			8.2		4.6			11.4			1.2		1.6			6.4	6.4
Martin Creek						0.0			0.0			0.0					0.0		0.0	0.0
Monticello				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
North			0.0			0.0	0.0			0.0			0.0						0.0	2.2
Ray Hubbard			10.0			2.0			7.9			5.1				0.0			5.0	13.3
Squaw Creek			1.8		0.0				0.0			4.8							1.7	4.6
Striker			0.0			0.0		0.0		0.0	0.0			0.0				0.0	0.0	1.6
Tradinghouse				0.0		0.0			0.0			0.0		0.0	0.0	0.0			0.0	0.7

Empty Cells Indicate that there was no survey for that year. CPUE = Catch Per Unit Effort.
Source: TPWD Reservoir performance rReports.

TABLE 2 (Cont'd)

Crappie Trap Net CPUE																			
	White crappie																		
Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
Colorado City			0.3			0.1			0.6			0.2	0.2		4.0				0.9
Eagle Mountain			4.0		9.0		5.0			1.4			3.4		3.2				4.3
Graham					11.0				5.6			10.8				3.6			7.8
Granbury			1.0		5.9		3.7			22.9			9.3			3.3			7.7
Fairfield		0.0	0.0			0.0		0.2			0.0			0.0	0.0				0.0
Martin Creek						1.1			2.7			0.1				0.0			1.0
Monticello				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					0.0
North							1.0			2.2			4.2						2.5
Ray Hubbard				5.0		7.0			9.0			6.1			14.1				8.2
Squaw Creek			0.0		1.0				0.0			0.2							0.3
Striker			1.6			1.8		1.5			1.9			0.2				1.8	1.5
Tradinghouse					1.6	0.8			4.2			0.8			1.8				1.8

	Black crappie																		Total
Reservoir	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean	Mean
Colorado City			0.0			0.0			0.0			0.0	0.0		0.0				0.0	0.9
Eagle Mountain			0.0		0.0		0.0			0.5			6.4		0.7				1.3	5.6
Graham					0.2				0.0			0.0				0.0			0.1	7.8
Granbury			0.0		0.1		0.0			0.0			0.0			0.0			0.0	7.7
Fairfield		4.4	2.8			0.0		0.6			0.0			0.0	0.0				1.1	1.1
Martin Creek						1.6						1.2				1.7			1.5	2.5
Monticello				0.0	0.2	0.0	0.8	0.0	0.0	0.2	0.6	1.6	1.2	0.3					0.4	0.4
North							0.0			0.0			0.0						0.0	2.5
Ray Hubbard				0.0		0.0			0.0			5.3			2.3				1.5	9.8
Squaw Creek			0.0		0.0				0.0			0.2							0.1	0.4
Striker			0.4			0.2		0.0			0.0			0.0				0.2	0.1	1.6
Tradinghouse					0.0	0.0			0.0			0.0			9.8				2.0	3.8

Empty Cells Indicate that there was no survey for that year. CPUE = Catch Per Unit Effort.
Source: TPWD Reservoir performance rReports.

TABLE 3
STANDING CROP AND TOTAL NUMBERS FROM COVE ROTENONE SURVEYS

Reservoir	Colorado City	Eagle Mountain	Graham	Granbury	Fairfield	Lake Creek	Martin Creek	Monticello	North	Ray Hubbard	Squaw Creek	Striker	Tradinghouse
Date	1985	No data	1983	1981	1985	1984	1985	1987	No data	No data	1981	1975	1987
Area (acres)	3	available	3	3.13	2.2	3	3.8	2.2	available	available	1.53	3.61	2
Standing Crop (pounds):													
Gizzard shad (*Dorosoma cepedianum*)	154.0		27.1	51.7	32.6	47.0	9.2	0.0			24.5	11.2	126.6
Threadfin shad (*D. petenense*)	3.1		1.3	4.2	0.8	1.8	1.9	5.7			0.0	0.1	26.1
Total shad	157.1	*	28.4	55.9	33.4	48.8	11.1	5.7	*	*	24.5	11.3	154.7
Largemouth bass (*Micropterus salmoides*)	13.1		4.2	6.6	144.1	16.0	11.5	53.8			47.0	14.6	69.0
Spotted bass (*M. punctulatus*)	0.0		0.0	0.8	0.0	1.4	0.0	0.0			0.0	2.3	0.0
Total black bass	13.1	*	4.2	7.4	144.1	17.4	11.5	53.8	*	*	47.0	16.9	69.0
White crappie (*Pomoxis annularis*)	0.0		1.8	2.5	0.0	0.3	1.0	0.0			0.0	0.0	0.2
Black crappie (*P. nigromaculatus*)	0.0		0.0	0.0	0.0	0.0	0.1	0.0			0.0	0.0	0.0
Total crappie	0.0	*	1.8	2.5	0.0	0.3	1.1	0.0	*	*	0.0	0.0	0.2
Channel catfish (*Ictalurus punctatus*)	13.2		4.7	8.1	36.4	6.3	2.0	55.1			1.9	3.3	234.7
Blue catfish (*I. furcatus*)	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
Total catfish	13.2	*	4.7	8.1	36.4	6.3	2.0	55.1	*	*	1.9	3.3	234.7
Bluegill (*Lepomis macrochirus*)	28.0		4.0	72.4	119.3	26.0	17.9	45.8			37.8	3.9	103.8
Other sunfish (*L. spp.*)	19.3		3.2	45.6	13.9	12.5	26.4	17.8			26.7	34.6	12.7
Total sunfish	47.3	*	7.3	118.0	133.2	38.5	44.3	63.6	*	*	64.6	38.5	116.5
White bass (*Morone chrysops*)	0.0		0.1	0.0	0.0	0.0	0.0	0.0			0.0	0.4	0.0
Striped bass (*M. saxatilis*)	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
Palmetto bass (*M. chrysops x M. saxatilis*)	0.0		0.0	0.0	0.0	0.0	0.3	0.0			0.0	0.0	0.0
Total temperate basses	0.0	*	0.1	0.0	0.0	0.0	0.3	0.0	*	*	0.0	0.4	0.0
Tilapia (*Oreochromis aureus*)	3.3			0.0	954.0	0.0	0.3	0.0			0.0	0.0	75.5
Other	52.3		83.3	71.8	275.0	31.7	41.3	4.4			16.3	9.2	159.4
Total	286.3	*	129.6	263.7	1,576.1	143.0	111.9	182.6	*	*	154.2	79.6	810.0

TABLE 3 (Cont'd)

Reservoir	Colorado City	Eagle Mountain	Graham	Granbury	Fairfield	Lake Creek	Martin Creek	Monticello	North	Ray Hubbard	Squaw Creek	Striker	Tradinghouse
Date		No data available							No data available	No data available			
Area (acres)													
Total number:													
Gizzard shad (*Dorosoma cepedianum*)	720.0		138.3	325.0	108.1	159.0	15.5	0.0			30.0	39.6	645.0
Threadfin shad (*D. petenense*)	679.0		220.4	343.0	155.2	662.0	183.4	518.1			0.0	32.5	4,075.0
Total shad	1,399.0	*	358.7	668.0	263.3	821.0	198.9	518.1	*	*	30.0	72.2	4,720.0
Largemouth bass (*Micropterus salmoides*)	142.5		146.1	73.0	1,817.7	114.0	404.2	1,473.2			340.0	109.2	376.0
Spotted bass (*M. punctulatus*)	0.0		0.0	16.0	0.0	21.0	0.0	0.0			0.0	19.8	0.0
Total black bass	142.5	*	146.1	89.0	1,817.7	135.0	404.2	1,473.2	*	*	340.0	129.1	376.0
White crappie (*Pomoxis annularis*)			13.2	49.0	0.0	9.0	2.8	0.0			1.0	10.4	1.0
Black crappie (*P. nigromaculatus*)			0.0	0.0	0.0	0.0	1.1	0.0			0.0	0.8	0.0
Total crappie	0.0	*	13.2	49.0	0.0	0.0	3.9	0.0	*	*	1.0	11.1	1.0
Channel catfish (*Ictalurus punctatus*)	110.0		53.3	17.0	68.9	34.0	21.7	64.4			2.0	51.3	690.0
Blue catfish (*I. furcatus*)	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
Totla catfish	110.0	*	53.3	17.0	68.9	34.0	21.7	64.4	*	*	2.0	51.3	690.0
Bluegill (*Lepomis macrochirus*)	879.0		195.0	3,218.0	1,853.4	906.0	2,498.6	2,352.3			14,473.0	167.7	3,968.0
Other sunfish (*L. spp.*)	796.9		141.7	1,661.0	245.3	285.0	1,253.9	739.3			3,914.0	1,014.4	301.0
Total sunfish	1,675.9	*	336.7	4,879.0	2,098.7	1,191.0	3,752.5	3,091.6	*	*	18,387.0	1,182.1	4,269.0
White bass (*Morone chrysops*)	0.0		0.6	0.0	0.0	0.0	0.0	0.0			0.0	1.4	0.0
Striped bass (*M. saxatilis*)	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
Palmetto bass (*M. chrysops x M. saxatilis*)	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
Total temperate basses	0.0	*	0.6	0.0	0.0	0.0	0.0	0.0	*	*	0.0	1.4	0.0
Tilapia (*Oreochromis aureus*)	4.2		0.0	0.0	4,388.5	0.0	0.6	0.0			0.0	0.0	3,212.0
Other	611.6		737.5	54.0	1,284.8	456.0	2,280.0	244.9			521.0	254.1	3,776.0
Total	3,943.2	*	1,646.1	5,756.0	9,921.9	2,637.0	6,661.8	5,392.2	*	*	19,281.0	1,701.3	17,044.0

* Data not available

The most recent cove rotenone survey for each reservoir are represented above.

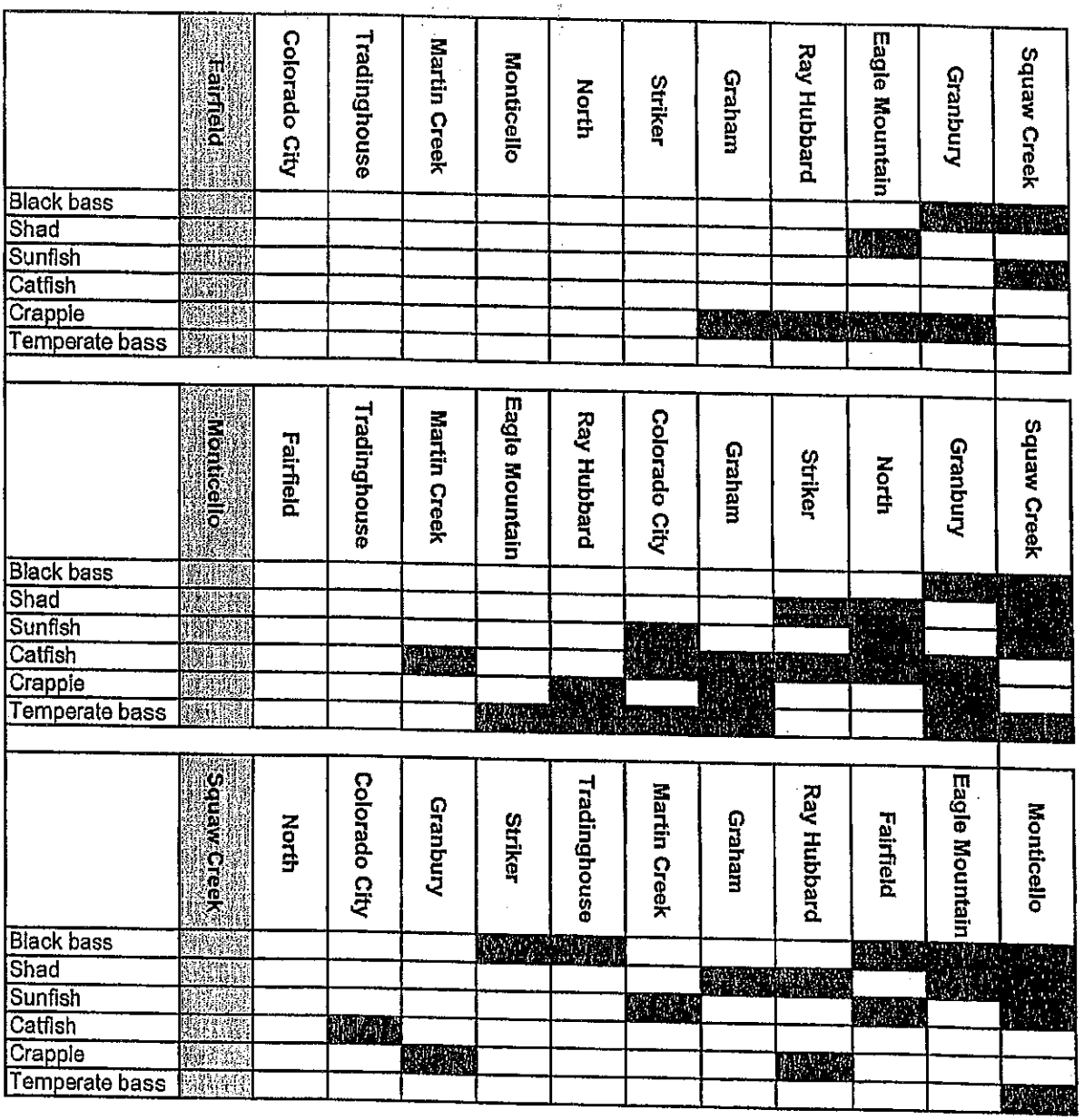
Source: TPWD Reservoir performance reports.

TABLE 4
SURVEYED HABITATS BY RESERVOIR

	Habitat Availability																												
	Shoreline/littoral																Open water												
Reservoir	Shoreline length (miles)	Nondescript (miles)	Nondescript (%)	Gravel (miles)	Gravel (%)	Rip-rap, rock, and boulders (miles)	Rip-rap, rock, and boulders (%)	Emerged aquatic vegetation including floating (miles)	Emerged vegetation (%)	Submerged aquatic vegetation (miles)	Submerged aquatic vegetation (%)	Total aquatic vegetation (%)	Boat docks and piers (miles)	Boat docks and piers (%)	Brush and trees (miles)	Brush and trees (%)	Percent total shoreline habitat	Reservoir area (acres)	Open water (acres)	Open water (%)	Trees and brush (acres)	Trees and brush (%)	Emerged aquatic vegetation including floating (acres)	Emerged vegetation (%)	Submerged aquatic vegetation (acres)	Submerged aquatic vegetation (%)	Total aquatic vegetation (%)	Percent total open-water habitat	Percent total habitat
Colorado City	24.0	12.8	53.2	2.0	8.2	1.7	7.0					0.0	6.4	26.6	0.9	3.6	45.4	1618	1618	100.0							0.0	0.0	22.7
Eagle Mountain	69.0	33.3	48.3	2.4	3.4	7.8	11.3					0.0	15.0	21.7	9.5	13.8	50.3	9200	9028	98.1	38.0	0.4	138.0	1.5			1.5	1.89	26.1
Graham	25.0	6.1	24.4	2.1	8.4	2.1	8.4	3.9	15.6			15.6	3.9	15.6	10.8	43.2	91.2	3000	3000	100.0							0.0	0.00	45.6
Granbury	106.0	70.3	66.3			3.6	3.6					0.0		16.0	31.5	29.7	49.3	6700	6700	100.0							0.0	0.00	24.7
Fairfield	30.0	11.5	38.4			0.5	1.6	6.9	22.9			22.9	0.1	0.2	11.3	37.7	62.4	2353	2353	100.0			160.0	6.8	204.0	8.7	15.5	15.47	38.9
Lake Creek	ND																												
Martin Creek	53.0	33.6	63.4			1.2	2.3					0.0			18.5	34.9	37.2	5000	2574	51.5	2426.0	48.5	1.0	0.0	0.1	0.0	0.0	48.54	42.9
Monticello	18.0	1.4	7.8			0.1	0.5	10.3	57.0	2.8	15.6	72.6			3.9	18.6	91.8	2000	2000	100.0							0.0	0.00	46.9
North	7.5	1.8	23.8			3.6	47.5	2.0	26.4			26.4			0.2	2.6	76.6	907	907	100.0							0.0	0.00	38.3
Ray Hubbard	69.0	24.2	29.2	0.5	0.6		0.0	22.1	26.6			26.6	1.4	1.7	34.7	41.8	70.7	22475	18282	81.3	3994.0	17.8			199.0	0.9	0.9	18.58	24.7
Squaw Creek	32.0	1.1	3.3	9.5	29.8	10.6	33.1	0.1	0.3			0.3			10.6	33.1	96.4	3272	3272	100.0							0.0	0.00	48.2
Striker	16.0	3.9	24.6			0.6	3.8	3.7	23.3			23.3	3.0	18.7	4.8	29.4	74.1	2400	2400	100.0							0.0	0.00	37.1
Tradinghouse	23.0	4.5	19.7			4.1	17.6	13.6	59.0			59.0					76.6	2012	2012	100.0					1.0	0.0	0.0	0.05	38.3

ND = Data not available.
Habitats represent most current surveys for each reservoir. (Some habitat fields in the reservoir performance reports were combined.)
Source: TPWD Reservoir performance reports.

TABLE 5
FISH COMMUNITY COMPARISON BETWEEN RESERVOIRS



Cells shaded in gray are the representative reservoirs. Cells without shading are indicate similarity at the 95% confidence level between reservoirs. Cells shaded in black indicate that the reservoirs are dissimilar.