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Advisory Board on Radiation and Worker Health
National Institute for Occupational Safety and Health

Evaluation of Revision 01 of the Technical Basis Document for Texas City Chemicals, Inc., Texas City, TX

Contract No. 75D30119C04183
Document No. SCA-TR-2020-SP002, Revision 0

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September 21, 2020

SC&A, Inc. Technical Support for the Advisory Board on Radiation and Worker Health's Review of NIOSH Dose Reconstruction Program

Document Title	Evaluation of Revision 01 of the Technical Basis Document for Texas City Chemicals, Inc., Texas City, TX
Document Number	SCA-TR-2020-SP002
Revision Number	0 (Draft)
Supersedes	N/A
Effective Date	September 21, 2020
Task Manager	Ron Buchanan, PhD, CHP [signature on file]
Project Manager	John Stiver, MS, CHP [signature on file]
Document Reviewer(s)	John Stiver, MS, CHP [signature on file]

Record of Revisions

Revision Number	Effective Date	Description of Revision
0 (Draft)	9/21/2020	Initial issue

Table of Contents

Abbreviations and Acronyms

ABRWH, Advisory Board	Advisory Board on Radiation and Worker Health
AEC	Atomic Energy Commission
AWE	Atomic Weapons Employer
BRS	Board Review System
dpm	disintegration per minute
ER	evaluation report
m^2	square meter
NIOSH	National Institute for Occupational Safety and Health
ORAUT	Oak Ridge Associated Universities Team
OTIB	ORAUT technical information bulletin
pCi	picocurie
SDC	Smith-Douglas Corporation
SEC	Special Exposure Cohort
SRDB	Site Research Database
TBD	technical basis document
TCC	Texas City Chemicals Inc.
U-238	uranium-238

1 Introduction and Background

Construction on the Texas City Chemicals Inc. (TCC) plant in Texas City, TX began in 1952. The plant was designed to produce animal feed and fertilizer from phosphate rock. The plant also had a contract with the Atomic Energy Commission (AEC) to construct a uranium recovery plant to extract uranium as a byproduct of the phosphates. TCC also had a development contract with the AEC to evaluate leach zone material. Preliminary operations began at both the new fertilizer plant and uranium recovery plant on October 5, 1953. The uranium recovery plant encountered a number of problems during startup and produced only a limited amount of uranium, approximately 300 pounds, for the AEC during the first few months of operation. Due to equipment problems, the plant never reached full-scale uranium production. TCC ceased operations in 1956 and filed for bankruptcy. Following bankruptcy in 1956, the Smith-Douglas Corporation (SDC) acquired TCC. SDC did not pursue uranium work with the AEC. SDC was later acquired by Borden Chemical, who operated the phosphate plant until it closed in 1977.

1.1 Texas City Chemicals SEC-00088

Petitioners filed a Special Exposure Cohort (SEC) petition in March 2007, covering the dates January 1, 1952, through December 31, 1956. On August 17, 2007, Petition SEC-00088 qualified for evaluation. The National Institute for Occupational Safety and Health (NIOSH) issued revision 0 of the SEC petition evaluation report (ER) for Petition SEC-00088 on January 18, 2008 (NIOSH, 2008). During the meeting of the Advisory Board on Radiation and Worker Health (Advisory Board) held on April 7–9, 2008, in Tampa, FL, the Advisory Board directed SC&A, Inc. to perform a review of the TCC SEC-00088 ER (ABRWH, 2008). SC&A issued that report July 18, 2008, and identified nine findings (SC&A, 2008).

During the May 8, 2009, Surrogate Data Work Group meeting (2009), NIOSH reported that a series of developments, including the discovery of new information, since the initial issue of the ER led to the need to revise the ER. Because of this, SC&A's findings in the ER review were not addressed in detail in the work group meeting.

NIOSH amended the ER on October 18, 2010 (NIOSH, 2010). The amended ER modified the covered period to October 5, 1953, through September 30, 1955, based on newly discovered documentation. The amended ER also recommended granting the SEC based on an inability to bound radon dose with sufficient accuracy. On November 17, 2010, the Advisory Board voted to accept the NIOSH SEC class recommendation (ABRWH, 2010). The SEC class includes:

> all Atomic Weapons Employer employees who worked at Texas City Chemicals, Inc., from October 5, 1953, through September 30, 1955, for a number of work days aggregating at least 250 work days, occurring either solely under this employment or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort. [NIOSH, 2010, p. 4]

1.2 Texas City Chemicals TBD, revisions 00 and 01

NIOSH issued a technical basis document (TBD) for TCC, DCAS-TKBS-0011, revision 00, "Technical Basis Document for Texas City Chemicals, Inc. Texas City, Texas" (NIOSH, 2017a),

to address exposures to workers for all cancers that are not covered by the SEC, and also for exposures during the residual period. In December 2017, the Advisory Board tasked SC&A to review the TCC TBD. SC&A issued its review of the TCC TBD, revision 00, in the report "Evaluation of Technical Basis Document for Texas City Chemicals, Inc., Texas City, Texas" (SC&A, 2018).

NIOSH issued revision 01 of the TBD for TCC on April 27, 2020 (NIOSH, 2020a), to (1) address comments from SC&A's (2018) review, (2) revise ingestions intakes during the residual period, and (3) implement text changes and update the document's format. NIOSH issued a memorandum on May 19, 2020 (NIOSH, 2020b), addressing SC&A's two observations and SC&A's summary of the nine SEC findings (SC&A, 2018). SC&A was tasked in June 2020 to review NIOSH's May 2020 memorandum in conjunction with revision 01 of the TCC TBD (NIOSH, 2020a).

2 Texas City Chemical SEC-00088 Findings

SC&A's review of the TCC ER for SEC-00088 (SC&A, 2008) identified nine findings. Since that review, the nine findings have been resolved. The resolutions to the nine SEC findings are outlined in the Board Review System (BRS).

2.1 NIOSH response to the nine SEC findings

NIOSH discussed the TCC SEC findings on page 2 of its May 2020 memorandum and recommended closing all nine (NIOSH, 2020b).

2.2 SC&A response to the nine SEC findings

SC&A concludes that the SEC findings have been resolved and recommends closure of all nine. SC&A updated the BRS on July 1, 2020, with a summary of the resolution and the recommendation to close each of the nine SEC findings.

3 Texas City Chemical TBD, Revision 00, Observations

SC&A (2018) had two observations from its review of the TCC TBD, revision 00 (NIOSH, 2017a).

3.1 Observation 1 – Combined intakes

> As written, SC&A finds that TCC TBD Tables 8 and 9 have the potential to be incorrectly interpreted, leading to unintentional underestimates of dose during the operational years. Calendar-day intakes are intended to be applied over an entire year, even when employment does not cover the entire calendar year. For example, the 1953 U-238 pCi/calendar day intake in Table 8 is presented as 41.3 pCi/day, and the covered period at the site begins October 5, 1953. Intuitively, this would result in an intake of 41.3 pCi for 87 days, or 3,593 pCi of U-238; however, this is incorrect. Instead, the table intends for the dose reconstructor to multiply 41.3 pCi by 365 days, despite the covered period beginning on October 5. The table notes seem to suggest the proper way to calculate annual dose; however, they have ambiguities, and note 1 references a

nonexistent note 3. SC&A would suggest intake per calendar day be converted to true annual intakes or further clarification added to the table to prevent misinterpretation. [SC&A, 2018, p. 13]

3.1.1 NIOSH's response to SC&A's observation 1

NIOSH resolution: NIOSH did not find errors in the intakes in Tables 8 and 9 but agrees with SC&A that the format of Tables 8 and 9 to provide annual average calendar day intake rates, in years in which the intake rate changes within the year, can be confusing. Therefore, the combined intake rates were removed from TBD. Tables 7, 8, and 9 were revised to only provide explicit calendar day intake rates for all specific periods of time. The change simplified the explanations needed in the TBD. TBD Revision 1 has the change. [NIOSH, 2020b, p.1]

3.1.2 SC&A's evaluation of NIOSH's response to observation 1

SC&A reviewed tables 7, 8, and 9, of TCC TBD, revision 01, their contents and footnotes, and found that the revisions clarified the data to be used in dose reconstruction. SC&A finds that this observation has been sufficiently addressed.

3.2 Observation 2 – Apparent inconsistence in ingestion method used during residual period

While NIOSH followed the procedure in OCAS-TIB-009 for deriving ingestion intakes during the TCC residual period, a different procedure was used in NIOSH's SEC-00236 ER during the residual period for the Metals and Control Corporation (NIOSH, 2017[b]). According the SEC-00236 ER, page 29, the ingestion intake (in units of dpm/hour) was derived by applying a factor of 1×10^{-4} m^2/hour to the surface contamination levels (in units of dpm/m^2) as a function of time. The TCC and the Metals and Control Corporation residual situations appear to be similar; therefore, it is not apparent why different methods were used to derive ingestion intake values during the residual period. [SC&A, 2018, p. 14]

3.2.1 NIOSH's response to SC&A's observation 2

Observation 2 resolution: SC&A noted that the NIOSH TCC TBD followed the ingestion intakes method in OCAS-TIB-009 and noted a different method was used in the Metals and Controls ER. NIOSH reviewed the ingestion calculation methods. The methods described in OCAS-TIB-009 were correctly applied to the TCC AWE operational period. However, those methods should not be applied to the residual contamination period; therefore, intakes from residual contamination were revised. Revision 1 of the TBD provides updated residual ingestion intake rates that assume the initial residual ingestion intake rate is equal to the ingestion intake rate during uranium recovery operations. The ingestion rate declines gradually in subsequent years according to the depletion factors in ORAUT-OTIB-0070. This TBD change results in an increase in the ingestion intake rate from residual contamination. [NIOSH, 2020b, p. 2]

3.2.2 SC&A's evaluation of NIOSH's response to observation 2

SC&A reviewed the derivation and revised ingestion values in tables 7 and 9 of TCC TBD, revision 01, for the residual period and found them to be appropriate and applicable for dose reconstruction. SC&A finds that this observation has been sufficiently addressed.

4 Summary and Conclusions

SC&A reviewed revision 01 of the TCC TBD (NIOSH, 2020a) and NIOSH's May 19, 2020, response memorandum (NIOSH, 2020b) in the context of SC&A's nine SEC findings (SC&A, 2008) and two TCC TBD, revision 00, observations (SC&A, 2018). SC&A (1) finds the nine SEC findings have been resolved and recommends closure and (2) finds that the two TCC TBD observations have been sufficiently addressed.

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