NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF RELEASE PREVENTION

Guidance for Toxic Catastrophe Prevention Act (TCPA)

Inherently Safer Technology (IST) Review

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Introduction

Pursuant to N.J.A.C. 7:31-4.12, facilities that are subject to the applicability requirements of the Toxic Catastrophe Prevention Act (TCPA) Program rules must complete Inherently Safer Technology (IST) reviews. The TCPA Program Rules are available at http://www.nj.gov/dep/rpp/brp/tcpa/tcpadown.htm.

The purpose of this guidance document is to assist owners or operators of planned or existing TCPA facilities in understanding the requirements for performing the IST review and preparing and submitting the IST review report. The Department suggests that owners or operators refer to "Inherently Safer Chemical Processes: A Life Cycle Approach," 2nd Edition, 2008, published by the Center for Chemical Process Safety (CCPS) of the American Institute of Chemical Engineers. This book presents the principles and strategies for applying inherently safer thinking throughout the life cycle of a facility.

I. When IST Reviews Must Be Completed

In accordance with N.J.A.C. 7:31-4.12(b), the IST review must be updated every five years at the same time the process hazard analysis with risk assessment (PHA/RA) for the covered process is due. In general, whenever a PHA/RA is performed, an IST review must also be performed. It is preferred that the IST review and PHA be performed concurrently. Conducting the IST Review concurrently with the PHA/RA is more time efficient, results in a more thorough review, and the same team can perform both studies. However, it may be necessary to supplement the PHA/RA team with members meeting the IST experience requirements.

II. Who Must Perform the IST Review

Each inherently safer technology review required by this section must be conducted by a team of qualified experts convened by the owner or operator, whose members must have expertise in environmental health and safety, chemistry, design and engineering, process controls and instrumentation, maintenance, production and operations, and chemical process safety. It is highly recommended that an operator be included in the IST review process.

III. What Must Be Studied in the IST Review

Each inherently safer technology review must identify all commercially available inherently safer technology alternatives or combinations of alternatives that minimize or eliminate the potential for an EHS release. Using any available inherently safer technology analysis method, this review must include, at a minimum, an analysis of the following principles and techniques:

1. Reducing the amount of EHS material that potentially may be released;

2. Substituting with less hazardous materials;
3. Using EHSs in the least hazardous process conditions or form; and
4. Designing equipment and processes to minimize the potential for equipment failure and human error.

Chapter 4 of the CCPS book referenced above covers each of these items.

IV. Methods to Conduct the IST Review

Any available inherently safer technology analysis method may be utilized to perform the IST review. There are, however, two methods which are commonly used:

1. Incorporating an analysis of the four IST principles listed in III. above into the PHA. This is a much more detailed analysis and is preferred to the checklist method. It is strongly recommended that an integrated PHA/IST study approach be used. When the team identifies a hazard in the PHA, it applies IST principles to evaluate and address the hazard. The following examples of this method are available:
   - See slides 65 - 68 in IST Concepts and Methodologies posted on the TCPA website at http://www.nj.gov/dep/rpp/brp/tcpa/tcpadown.htm.
   - See Method 3 on pages 12-15 in IST Sample Worksheets also on the TCPA website.
   - Chapter 11 of "Inherently Safer Chemical Processes: A Life Cycle Approach," 2nd Edition, 2008, has worked examples and case studies of IST principles and concepts.

2. A checklist method. The Center for Chemical Process Safety (CCPS) of the American Institute of Chemical Engineers (AIChE) has prepared a checklist in Appendix A in "Inherently Safer Chemical Processes: A Life Cycle Approach." Some facilities have used similar variations of this checklist. For a new facility, the checklist approach could be used for a more global evaluation of the process. During the design phase of a new facility or process, it is easier to implement substitution.

V. Determining the Feasibility of IST Alternatives

Each inherently safer technology review must include a determination of whether each of the inherently safer technologies identified is feasible. For purposes of this determination, feasible is defined at N.J.A.C. 7:31-1.5 as "capable of being accomplished in a successful manner, taking into account environmental, public health and safety, legal, technological, and economic factors."

See Attachment 1 for a discussion of feasibility.

VI. IST Review Report

The owner or operator must prepare and submit to the Department a report that documents each inherently safer technology review required by this section. For existing facilities, IST reports prepared for the 5-year PHA/RA update and management of changes must be submitted with the next annual report pursuant to N.J.A.C. 7:31-4.9(b)6. For new covered processes, the report must be sent to the Department as part of the new covered process submittal pursuant to N.J.A.C. 7:31-4.12. The report must include:

a. An identification of the covered process that is the subject of the review; a list of the review team members with name, position, affiliation, responsibilities, qualifications, and experience for each; the date of report completion; and the inherently safer technology analysis method used to complete the review;

b. The questions asked and answered to address the inherently safer technology principles and techniques pursuant to 7:31-4.12(d). This is the detailed worksheets used to address and analyze the four IST principles. If you used the CCPS checklist method, submit the completed checklist. If you incorporated the IST review into the PHA, you can submit the complete PHA worksheets, or you can extract the sections that address the four IST principles.

c. A list of inherently safer technologies determined to be already present in the covered process. This should be a complete, current list of all ISTs that have been included in the process. (It must be a separate **list** that only itemizes the ISTs already present**;** other formats are not acceptable.**)**

d. A list of additional inherently safer technologies identified in this current IST review. (It must be a separate **list** that only itemizes the additional ISTs identified**;** other formats are not acceptable**)**. If no additional ISTs were identified, state so.

e. A list of the additional inherently safer technologies selected to be implemented and a schedule for their implementation. (It must be a separate **list** that only itemizes the additional ISTs selected to be implemented**;** other formats are not acceptable**)**. If no additional ISTs were selected to be implemented, state so.

f. A list of the inherently safer technologies determined to be infeasible. (It must be a separate **list** that only itemizes the ISTs determined to be infeasible**;** other formats are not acceptable**)**. If no ISTs were determined to be infeasible, state so.

g. A written explanation justifying the infeasibility determination for each inherently safer technology determined to be infeasible. The owner or operator must substantiate the infeasibility determination using a qualitative and quantitative evaluation of environmental, public health and safety, legal, technological, and economic factors. If infeasibility of a particular IST is not established in accordance with the rule, it would be considered feasible. However, the *implementation of any IST determined to be feasible is **not** mandatory*.

See Attachment 2 for a sample report.

VII. Confidentiality

An owner or operator may file a claim with the Department pursuant to N.J.A.C. 7:31-10 to withhold from public disclosure confidential information included in an inherently safer technology review report required to be submitted to the Department. (Details are available at http://www.nj.gov/dep/rpp/brp/tcpa/tcpadown.htm under the Special Topics section.) N.J.A.C. 7:31-10.4 specifies how a facility must submit confidential information; this includes requirements such as marking the document, sealing it in a separate envelope marked "**CONFIDENTIAL"**, and providing a complete confidential information claim form. If a request is made by the public to view the information claimed confidential, the Department will contact the claimant to substantiate the confidentiality claim.

Attachment 1

Feasibility Guidance

Determine whether IST is feasible, that is, capable of being accomplished in a successful manner, taking into account the following factors:

- Environmental
- Public health and safety
- Legal
- Technological
- Economic

Feasibility Factors Examples:

Under each factor below except for economic feasibility, some examples are listed for illustration purposes. These examples are not intended to be all-inclusive. Also, a clarification is included whether a qualitative and/or quantitative justification is expected.

A. Environmental and Public Health and Safety Feasibility
   - There would be a significant negative environmental impact (Consideration of water resources, water pollution, air pollution, solid and hazardous wastes, noise, etc.
   - The IST could decrease the hazard but would increase the overall risk
   - The risk would be shifted to another location where the risk would be the same or higher (If infeasibility is claimed because of risk, you need to document the difference in frequency and/or consequences with and without the IST.)
   - (All of the above require both qualitative and quantitative justification.)

B. Legal Feasibility
   - The IST could result in a conflict with existing federal, state, or local laws
   - The IST could violate a license agreement and the license agreement cannot be modified and must remain in effect
   - (Qualitative justification is required for both.)

C. Technological Feasibility
   - Is in conflict with Recognized and Generally Accepted Good Engineering Practices (qualitative, cite reference documents)
   - Product quality specifications cannot be met (qualitative and quantitative)
   - Availability of materials (qualitative and quantitative)
   - Space restrictions (qualitative and quantitative)
   - Impact on production rate (qualitative and quantitative)
   - Commercially available or not (qualitative)

D. Economic Feasibility
   - If a given IST is claimed to be infeasible due to economic reasons the infeasibility justification should address the following elements:
   - Life Cycle Analysis
   - Capital investment, including design and implementation
   - Net operating costs
   - Change in the cost of materials including transportation and handling related costs

Change in energy consumption
Change in human costs such as number of operators, training
Any other direct manufacturing costs
Net regulatory compliance cost, change in fees
Demolition and future cleanup and disposal cost
Non-affordability of an IST alternative relative to the o/o's facility

Quantitative (cost/benefit analysis)

Generally, an IST is feasible if the IST has been successfully applied to similar processes or similar situations unless there are unique circumstances at the facility. The justification should highlight those unique circumstances and how they relate to the feasibility factors.

Attachment 2

Sample IST Report

1. **Identification of Covered Process(es):**

   Date of Report Completion:

   IST Analysis Method Used:

This is the IST Report for the XYZ Company (TCPA ID# 9999) for the IST review performed in conjunction with the PHA for the chlorine reaction process. The report was completed on July 1, 2014. The What-if method was used to perform the review. The review team members are listed in the table below.

List of IST Review Team Members:

Name	Position	Affiliation	Responsibilities, Qualifications, Experience
John Brown	Partner	ABC Consulting, LLC	17 years experience in leading PHAs, BS Chemical Engineering
Mary Jones	SHE Manager	XYZ Company	22 years experience in chemical industry
James Smith	Lead Engineer	XYZ Company	Developed chlorine process. Managed process since its inception
Robert Johnson	Process Engineer	XYZ Company	MS Chemical Engineering 10 years experience process controls and instrumentation
Joseph Williams	Maintenance Manager	XYZ Company	16 years experience in chemical industry – maintenance
Susan Jackson	Operator	XYZ Company	32 years of operating experience

2. **Questions Asked and Answered to Address IST Principles and Techniques:** The IST review was performed as part of the PHA revalidation. The worksheets developed during the IST Review which list the questions asked and answered are attached in Appendix 1.

3. **List of Inherently Safer Technologies determined to be already present:**

   a. Chlorine detectors and alarms

   b. Bulletproof glass in chlorine room windows

   c. Ton containers are inside a chlorine room

   d. Automatic shutdown activated by leak detector

   e. etc.

4. **List of Additional ISTs Identified:**

No additional IST was identified.

Or

The following additional ISTs were identified:

   a. Use another reactant instead of chlorine

   b. Use 150 lb cylinders rather than ton containers.

   c. Add a scrubber to remove chlorine in the event of a release

   d. etc.

5. **List of Additional ISTs Selected to be Implemented Including Implementation Schedule:**

Since no new IST was identified, there is no list of those selected.

Or

- Item c above was selected to be implemented. The scrubber will be added in the third quarter of 2015.

6. **List of ISTs Determined to be Infeasible:**

Since no new IST was identified, there is no list of those deemed to be infeasible.

Or

6. Item a. was deemed to be infeasible since, while iodine is much safer than chlorine, it doesn't react nearly as well. (The facility owner/operator must provide detailed information comparing other potential reactants with chlorine for reactivity data, different equipment needed, room required, or that it couldn't meet other regulatory requirements, etc.)

Item b. was deemed infeasible because it was felt that the frequent changing of 150 lb. cylinders which would be required by the amount of chlorine utilized would actually increase the risk

associated with the process rather than decreasing it. (The facility owner/operator must provide detailed information comparing the risks of both cases (an analysis comparing the consequences and likelihoods of both cases). It is infeasible only if the facility owner/operator can show that the risk at the facility would be greater with the potential IST alternative.

Note that the above sample is very simplistic. Actual IST review will, in most cases, produce numerous examples of existing IST and perhaps numerous items of new IST which may or may not be feasible and which may or may not be implemented. A PHA will often list hundreds of questions which were asked as part of the revalidation process. What this example does is provide a very rough guide to the information the Department expects to see included in an IST Review report.

Appendix 1

Attach the detailed worksheets used in the IST Review, which provide all the questions asked and answered for the review.