

STATE OF NEW YORK  
TAX APPEALS TRIBUNAL

---

In the Matter of the Petition	:	
of	:	
<b>UNION CARBIDE CORPORATION</b>	:	DECISION
for Revision of a Determination or for Refund	:	DTA No. 809943
of Sales and Use Taxes under Articles 28 and 29	:	
of the Tax Law for the Period April 1, 1983	:	
through June 30, 1986.	:	

---

Petitioner Union Carbide Corporation, 39 Old Ridgebury Road, Danbury, Connecticut 06817-0001, filed an exception to the determination of the Administrative Law Judge issued on July 21, 1994. Petitioner appeared by Robert A. Fiscella, Esq. The Division of Taxation appeared by William F. Collins, Esq. (John O. Michaelson, Esq., of counsel).

Petitioner filed a brief in support of its exception. The Division of Taxation filed a brief in opposition. Petitioner filed a reply brief on October 31, 1994, which date began the six-month period for the issuance of this decision. Oral argument was not requested.

Commissioner Dugan delivered the decision of the Tax Appeals Tribunal. Commissioner Koenig concurs.

***ISSUE***

Whether the computer-aided design engineering system purchased by Union Carbide Corporation during the audit period qualifies for an exemption from sales and use taxes under Tax Law § 1115(10) and 20 NYCRR 528.11 as equipment used predominantly "in research and development in the experimental or laboratory sense."

***FINDINGS OF FACT***

We find the facts as determined by the Administrative Law Judge except for findings of fact "4" and "15" which have been modified. We have also incorporated the Administrative Law Judge's finding of fact "16" into finding of fact "4." The Administrative Law Judge's findings of fact and the modified findings of fact are set forth below.

Petitioner, Union Carbide Corporation, operates a large facility in Tonawanda, New York, known as the Linde Gas Division of Union Carbide. It engages in the business of designing industrial gas plants and selling atmospheric gases to various customers. In most instances, the plant is owned by Union Carbide and petitioner sells the gas.

During the period in issue, petitioner expanded its Computer Aided Design Engineering System ("CADE system") in order to assist in its design of industrial gas plants. The Capital Budget Proposal pertaining to the expansion of the CADE system explained that the "CADE system would allow the application of CADE technology to all major activities of Air Separation Plant Design Engineering."

The CADE system represented an advancement in the prevailing technology with respect to the design and analysis of air separation plants or industrial gas plants. It is analogous to a PC network, except that the CADE system is used for engineering analysis rather than for word processing or simpler applications. The CADE system includes floor computers, desk top terminals, plotters, graphic presentation equipment and related software, equipment and articles dedicated to the foregoing activities.

We modify finding of fact "4" of the Administrative Law Judge's determination to read as follows:

Petitioner paid sales and use tax on the purchase of the CADE system and on December 2, 1986 filed an Application for Credit or Refund of State and Local Sales or Use Tax in the amount of \$273,541.08. Petitioner received an Advisory Opinion, dated January 15, 1988. The substantive opinion was as follows:

"Petitioner performs research in order to produce for sale to consuming manufacturers on the world market various atmospheric

gases of greater and greater purity by using and developing 'state of the art' technology and equipment to effect the production of these gases in the most efficient manner that allows economy of scale and cost to be met when this equipment is installed and erected as a plant facility on the customer's property. The facility, modified as required to the topography of the customer's land site, is directly hooked up to and feeds the customer's own production equipment.

"Petitioner utilizes computer-aided design and engineering equipment (hereinafter C.A.D.E.) to develop three dimensional electronic models of integrated components of production equipment for sale or for integration into a plant facility that has the overall general characteristics of size and dimension to comply with the exigency of economy of cost and scale allowing for future expansion.

"The customer either purchases the newly developed gas producing facility outright to produce its own gas, or buys a package which includes as required the constant provision and purchase of the purest available gas delivered by client-owned atmospheric gas producing equipment. The C.A.D.E. equipment referred to includes floor computers, desk top terminals, plotters, graphic presentation equipment and related software, equipment and articles dedicated to the above type activities.

"The use of computer equipment has already been recognized as qualifying for the research and development exemption under certain circumstance [sic]. In HOUDAILLE Industries, Inc., Advisory Opinion of the State Tax Commission, May 1, 1985, TSB-A-85(13)S, it was determined that:

'The use of the CAD/CAM by Petitioner to draw the relative dimensions of machine parts pursuant to customer request as described above contains no element of research and development and is nothing more than the ordinary design and drafting of machine parts. However, the use by Petitioner of the CAD/CAM for purposes of experimenting with different configurations to test the ability of the configurations to comply with design standards falls within the purview of Example 4 as cited above and is, therefore, deemed to be used directly in research and development.'

"Clearly, to the extent that the C.A.D.E. equipment is used to perform research and experimentation to develop better and more efficient production equipment, it is being used to advance the technology in a technical field of endeavor within the meaning of regulation section 528.11(b)(1).

"However, to qualify for exemption, the C.A.D.E. equipment must be used predominantly (over 50% of the time) in research and development. If the C.A.D.E. equipment is used more than 50% of the time in activities other than research it does not

qualify for exemption. For example, the use of C.A.D.E. equipment for ordinary design and drafting functions does not qualify as research and development in the experimental or laboratory sense. Moreover, the use of C.A.D.E. equipment to establish facility configurations or to modify facilities to conform to the topography of the customer's land site does not qualify as research and development in the experimental or laboratory sense.

"Additionally, to qualify for exemption, the C.A.D.E. equipment must be used directly in research and development. Usage in activities collateral to research and development (e.g. administrative and management functions) does not qualify as research and development.

"Accordingly, if the C.A.D.E. equipment is used directly and predominantly (more than 50% of the time) for qualified purposes, it will qualify for the exemption provided by section 1115(a)(10) of the Tax Law."

By letter dated August 30, 1989, the Division forwarded to petitioner a detailed analysis of the matter, done by the Division's Law Bureau at the request of the Audit Division, which concluded that while some of the equipment is used directly in research and development, exact percentages could not be determined from the information presented to the Law Bureau.

In a letter dated September 20, 1989, petitioner's claim for refund was denied on the ground that the CADE system was used largely in design engineering and not research and development. Following a conciliation conference, the Bureau of Conciliation and Mediation Services, on May 31, 1991, issued a conciliation order which denied the request for refund. Petitioner then filed a petition with the Division of Tax Appeals which contested the denial of the refund claim to the extent of \$162,721.40, plus interest. At this juncture, the only matter in issue is whether petitioner's purchase of the CADE system is subject to sales and use taxes.<sup>1</sup>

---

1

Finding of fact "4" of the Administrative Law Judge's determination read as follows:

"[p]etitioner paid sales and use tax on the purchase of the CADE system and thereafter filed an Application for Credit or Refund of State and Local Sales or Use Tax in the amount of \$273,541.08. In a letter dated September 20, 1989, petitioner's claim for refund was denied on the ground that the CADE system was used largely in design engineering and not research and development. Following a conciliation conference before the Bureau of Conciliation and Mediation Services, which denied the request, petitioner filed a petition with the Division of Tax Appeals which contested the denial of the refund claim to the extent of \$162,721.40, plus interest. At this juncture, the only matter in issue is whether petitioner's purchase of the CADE system is subject to sales and use taxes."

We modified finding of fact "4" to include finding of fact "16" of the Administrative Law Judge's determination, modified to include the entire substantive portion of the Advisory Opinion, in order to provide a clearer chronology of the events in this case.

There are a variety of facilities that use petitioner's services, including industrial plants such as steel mills, chemical plants or glass making facilities. Petitioner would also design and custom build a plant in order to supply a hospital with oxygen. Most of the facilities that petitioner designs and builds using the CADE system address specific customer requirements and are therefore custom designed.

The facilities designed by petitioner are unique because they depend on the type of gas that is used, the purity of the gas, the phase of the gas, the geographic location and the atmospheric conditions. For example, other things being equal, a plant in Denver and a plant in Houston would be different because barometric pressure and humidity are different.

In designing a plant, one has to proceed through a considerable search to find the routing and parameters that will satisfy the thermal and mechanical requirements. The optimal solution is arrived at through a trial and error process which consumes the most significant portion of the time that one is using the system. For example, if the question concerns a piece of pipe, one is concerned about energy utilization and its relationship to pressure, the material, wall thickness and the diameter that will satisfy the stress requirements. The production of the drawing uses a relatively small amount of time. Ultimately, petitioner is trying to design a plant that meets a customer's needs, design specifications and is economical to build.

Each plant is different. In the past 18 years, there has been only one customer that purchased two plants with the intention that they be identical. Thereafter, petitioner tried to make them identical. However, because of utility considerations and differences in locations (Ohio versus Pennsylvania), there were significant design differences. Even in this case, petitioner had to proceed through the same step-by-step analysis and could not simply reuse the design developed for the first plant.

The CADE system is involved in the analysis and documentation of the design. As a last step, after the drawings are produced, they are furnished to contractors who bid on the construction of the plant. The CADE system is not involved in the building of the plant.

Petitioner has a Research and Development Department which operates independently of the Engineering Department. The Research and Development Department develops fundamental technology in terms of air separation. For example, one project of the Research and Development Department was the design of a liquid hydrogen trailer which could carry 16,000 gallons of liquid hydrogen while the previous state-of-the-art trailer could carry only 7,800 gallons.

The Engineering Department is separated from the Research and Development Department because the motives are different. In Research and Development, new technology is discovered. In engineering, the technology is applied to economic uses. Nevertheless, the Engineering Department sometimes obtains patents on its work.

The Research and Development Department and the Engineering Department are similar in that the same scientific principles are applied. However, the Research and Development Department is not geared toward a specific project, whereas the Engineering Department is directed towards a specific customer or project. Except in the area of turbo machinery design, the Research and Development Department did not use the CADE system.

As a framework for analysis, petitioner provided an outline which described the tasks performed by the various departments using the CADE system and the percentage of time that each department uses the system on that task. To the extent that the items were in issue at the hearing, portions of this framework are set forth below in conjunction with other evidence adduced at the hearing.

(a)(1) Under the title of Control Systems Engineering and the subtitle of calculations, petitioner asserted that the following items are exempt from tax:

<u>"Item</u>	<u>Description</u>	<u>Dept. % Use</u>
C.1.A Orifices, Annubar & Flow Tube Sizing	It is the responsibility of the Engineer to optimize the performance of all the flow measuring devices in plant process streams. The procedure requires a trial and error analysis of the effects on the devices' performance when the design parameters change for varying plant operating points. For each pressure, temperature and flow relation the resultant signal level vs control response must be analyzed. The purpose is to achieve the best signal possible with a reliable control response to the process change. It is the manipulating of these parameters that will produce the final design definition for these devices.	5%
C.1.B Automatic Valve Sizing	Automatic valves are the final control elements in process control. They adjust the process based on the operating parameters entered into the system by the Plant Operations Personnel. The interaction of the process measuring devices, the control devices and the final control element must be synchronized to provide the optimal performance for the system. The Engineer must perform an automatic valve sizing calculation for each operating point that each valve will see in the course of plant operation. The valve must have the required capacity to control the design flow and yet provide a rangeability to meet all operating conditions. Through a trial and error procedure the Engineer determines the optimal valve design and size to meet all process requirements."	8%

(2) In order to satisfy the requirements of a particular customer, petitioner has to go through and provide the proper control and flow measurement devices. The engineer uses the CADE system to develop the designs and sizes taking into account the physical configuration of the piping. In the past, petitioner had less than an optimal configuration which was not nearly as efficient. It was also subject to larger fluctuations.

(3) Petitioner considered items C.1.A. and C.1.B. exempt from tax under 20 NYCRR 528.11(b)(1) because they were used to develop new products and/or improve existing products. The Division's Law Bureau, in a memorandum dated August 7, 1989, considered the foregoing items taxable for the following reasons:

- "C.1.A.                      Applying known equations to Varying conditions  
is applied engineering, not R & D.
- "C.1.B.                      Although the write-up is unclear, it appears  
merely to be sizing up the right valve, and the like; i.e.,  
applied engineering, not R & D."

(b)(1) Under the category of Control Systems Engineering, petitioner listed steps to "update and/or develop instrumentation drawings to reflect new or improved control philosophies" as follows:

<u>"Item</u>	<u>Description</u>	<u>Dept. % Use</u>
C.2.A. Process & Instrumentation Drawings	The project team members (there are usually more than one) must develop graphic documentation that represents the process and the instrumentation controlling that process. The documents must be correlated with the type of equipment being used on the project to insure that they are compatible. The instrumentation must also meet design pressures and temperatures as defined for the project. Thus it is necessary for the team members to update and/or modify the graphic models as the scope of the project equipment changes. In addition all new process areas that have not been addressed to date must be developed which in most cases involves a number of decisions as well as trial and error iterations.	10%
C.2.B. Schematic Wiring Diagrams	The development of the wiring diagram is a similar effort to that of the process diagram discussed in section C.2.A above. The wiring diagrams are used to document the electrical aspects of the control system. The rating of the equipment and its functional operation require the engineering group to verify the electrical design meets all requirements and safety guidelines. The graphic representation will thus change as the scope of the electrical definition for the project changes and involves a decision making process on the part of the project team members.	12%
C.2.C. Control Loop Diagrams	The control loop diagram is a detailed definition of the control instrumentation. It must document all of the process connected instruments as well as all of the	10%

electrically connected equipment as they relate to one another on a loop by loop bases. Each loop being an entity in itself is developed to detail a particular control point in the overall plant control scheme.

C.2.D. Logic Diagrams	Logic diagrams document the functionality of the plant logic control network. Each input and output and the intermediate control logic involved to achieve the result must be developed and documented. The arrangement of the networks must be very carefully considered as it will effect the operation of the overall plant control in relation to response time, etc."	7%
--------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----

(2) At the hearing, the Division of Taxation ("Division") explained that it considered the foregoing activities taxable because it appeared to the Division that petitioner was engaging in draftsmen's activities such as producing blueprints and drawings. Prior to the hearing, the Division's Law Bureau set forth the following explanation of why it considered the foregoing items taxable:

- "C.2.A.            1. Developing and verifying process and instrument circuitry graphics is not R & D.  
                         2. Ensuring that instrumentation meets design constraints is akin to quality control.  
                         3. Describing new process areas in graphic format is not R & D.
- "C.2.B.            1. Application engineering of known data relating to wiring diagram is not R & D.  
                         2. Verifying design against safety guidelines is akin to quality control.
- "C.2.C.            Producing schematics of control loops of related instruments and of electrical connections sounds [sic] is descriptive. Sounds like creating instruction manuals.
- "C.2.D.            Documenting logic control-same as C.2.C."

(3) At the hearing, petitioner's witness testified that, in the past, an engineer or technician would develop the control system using a series of sketches and then give the information to a service drafting organization which would use a CAD (computer-aided design) system to devise the process instrumentation, schematic diagrams, control diagrams and logic diagrams. Today, the engineer and technician use the CADE system to develop a control system and the diagrams are a by-product of the design and development process.

(4) Petitioner submits that C.1.A. through C.2.D. are exempt from tax under 20 NYCRR 528.11(b)(1) because the CADE system is used to develop new products and/or improve existing products.

(c)(1) Under the subtitle of Mechanical Design Engineering, petitioner asserted that the following activities, except for D.2 which is conceded taxable, were exempt from sales and use taxes:

<u>"Item</u>	<u>Description</u>	<u>Dept. % Use</u>
D.1 2-D Plant Layout	It is the responsibility of the Mechanical Design Engineer and the Mechanical Designer to develop process plant layouts for both proposal type work and authorized capital projects. As part of the process of developing the plant layout, equipment is arranged in various combinations to develop the most cost effective facility which includes the initial installation of plant, operation and maintenance. The above process is repeated until all the business, processes and operation constraints are met.	5%
D.2 Equipment Modeling	Once a project becomes authorized it has to be fully designed. As part of the design process, numerous pieces of equipment are selected to meet the process objectives.	10%

Once the equipment has been defined to meet the process or specifications, a mechanical piece of equipment is then selected. This piece of mechanical equipment is either fabricated by Linde or supplied by an outside vendor. Once this has been determined, the Mechanical Design CADE operator takes the information from the equipment vendor drawing and converts that information into an electronic 3D model on the system. This process is repeated over and over again until all the mechanical components have been electronically modeled.

D.3  
Equipment Rotation and  
Optimization

Upon completion of the equipment modeling, the equipment is placed in its proper plant layout location. The Mechanical Designer and Mechanical Engineer then evaluate the location of the numerous pieces of equipment and determine on how to rotate or translate the piece of equipment to minimize piping runs and electrical feeder runs. This process is repeated for all the components.

5%

D.4  
Pipe Routing and  
Optimization

Once the equipment location has been finalized, the Mechanical Design Engineer and the Mechanical Designer are responsible for routing all the process piping lines. The pipe routing must be done in such a fashion as to minimize systems pressure drop, but yet also taking constraints of the process flow philosophy. Numerous pipe routings from the various pieces of equipment are tried in order to achieve the optimum pipe routing system that will deliver the minimum installed costs along with the

40%

	lowest possible system pressure drop.	
D.5 Solid Modeling	Sometimes it is preferred to display the 3D model as a solid as opposed to a wire frame model, and this technique is used for that application.	1%
D.6 & D.7 Flexibility Analysis Pressure Drop Analysis	The Mechanical Design Engineer and Mechanical Technician perform various calculations to determine the piping flexibility and the piping system pressure drop.	4%
D.8 Interference Checking	The interference checking is a system program that is run to identify any interferences that may exist. An example of this would be a pipe running into a building wall."	2%

(2) The Division considered each of the foregoing activities taxable because it involved the layout of the manufacturing plant. Prior to the hearing, the Division provided the following explanation of why it considered the foregoing items taxable:

- "D.1.A.<sup>2</sup> Developing process plant layouts, even repeatedly, is application and/or design engineering, not R & D in the laboratory sense.
- "D.2.A. Picking and choosing pieces of existing equipment and arranging them to achieve an optimal solution is not R & D.
- "D.3.A. Application engineering, not R & D.
- "D.4.A. Same as D.3.A.
- "D.5.A. Not R & D in laboratory sense.

---

2

The corresponding items on petitioner's outline are not designated with a letter "A" under section D.

"D.6.A. & D.7.A. Same as D.3.A.

"D.8.A. Same as D.3.A."

(3) In item D.1, plant layout, petitioner is utilizing the capabilities of the CADE system to optimize the layout of the particular facility. Petitioner has to work with a number of constraints such as those mandated by the physical location of the plant, elevation of the plant or constraints caused by the building. There may also be requirements imposed by a municipality or electrical requirements. Petitioner uses the CADE system to optimize the plan within the constraints.

(4) Before petitioner used the CADE system, it used paper cutouts to consider various configurations. This method was very limited because one could only see in two dimensions. Further, the accuracy of the method was doubtful.

(5) Petitioner concedes the item D.2, equipment modeling, is taxable. This equipment is selected by a team of people who are not using the CADE system. In order for petitioner to incorporate the specific equipment into the development of the plan, it has to be modeled three dimensionally. Therefore, petitioner has operators on the system who take the information and specifications from the equipment and develop it into a three-dimensional model. This does not improve the equipment. Rather, it provides petitioner with the basis for which to begin to develop the detailed design.

(6) Item D.4 is the activity of developing the design. Petitioner takes the models and places them into the plan layout that was developed earlier. Petitioner then begins, through trial and error, to route the various aspects of the plant.

(7) Solid modeling, D.5, is a visualization technique that allows the engineer or designer to view the design in a form that is as close to reality as can be achieved electronically. This helps provide the perspective that allows the engineer or designer to improve the product.

(8) Petitioner submits that D.1 and D.3 through D.8, inclusive, are exempt under 20 NYCRR 528.11(b)(1) because they are used to develop new products and/or improve existing products.

(d)(1) Under the title of Civil Design Engineering, petitioner asserts that the following items are exempt:

<u>"Item</u>	<u>Description</u>	<u>Dept. % Use</u>
E.1 through E.6 Foundation Design for Equipment, Buildings, Pipe Racks, Misc. Underground Process and Utility Piping Design Building Design Structural Steel Design Site Development Layouts	<p>It is the responsibility of the Civil Engineer and Civil Designer to provide the structural engineering and architectural and construction drawing detailing [sic] of the mentioned items. In the course of evaluating alternate architectural and structural schemes and concepts the CADE System allows rapid revision, optimization, visualization, and material quantity calculation to aid in evaluating the optimal cost effective solution(s). In combination with personal computer interface many trial-and-error options can be quickly and accurately evaluated. In the evaluation process, the impact of schemes and concepts can be merged quickly with other on-going CADE design activities from other departments to help access the relative desirability on overall project functionality, reliability and cost effectiveness.</p> <p>The merging together of site development, utility and structural steel, foundation and building models allows either visual or electronic interference checking which minimizes costly field</p>	100%

installation interferences."

(2) It is the Division's position that in the foregoing items petitioner is taking information that was obtained from the customer's site and designing a piece of equipment that would be placed there. The Division considered these activities to be taxable because they were design engineering and not research and development in the laboratory sense despite the repeated revisions that are made to minimize costs.

(3) With respect to civil design engineering, petitioner must consider the topography of a particular site. There are various options available to the civil designer in terms of how he or she wants to configure the civil aspect of the plant, such as the placement of the foundation, the amount of steel or the configuration of the steel. The CADE system provides the civil engineer and the civil designer the opportunity to try various cases and configurations and determine what is optimum given the fact that it must conform to the physical constraints that are imposed by the site selection. That is, one is looking from the standpoint of the cost of the foundation, the schedule of the foundation and making sure that the foundation satisfies the load-bearing requirements of the particular facility.

(4) Petitioner submits that items E.1 through E.6 are exempt from tax under 20 NYCRR 528.11(b)(1) because they are used to develop new products and/or improve existing products.

(e)(1) Petitioner listed the following items under Electrical Design Engineering:

<u>"Item</u>	<u>Description</u>	<u>Dept. % Use</u>
F.1.A Layout Switchgear Bldg. and Related Electrical Equipment	Once equipment is modeled make [sic] a layout to achieve optimum utilization of space, by arranging and rearranging equipment relationships. This is essentially a trial and error process until an optimum relationship is found.	5%
F.2.A Underground Conduit Design	Layout of underground conduit duct banks for optimum cost savings of conduit and concrete. Then rearrange and improve routing so as to avoid underground obstacles such as foundations, water lines and	20%

	etc.	
F.3.A Ground Grid	Develop a ground grid consisting of ground wires and ground rods to provide sufficient equipment grounding, achieving loops as much as possible while still considering economics.	5%
F.4.A Cable Tray Design	Layout cable using as many common mechanical pipe supports as possible. This results in rearranging the layout so that cable tray does not hit any obstacles. Rerouting is also done to improve the economics of the system.	20%
F.5.A Aboveground Power and Control Design	Using the electronic communications between the mechanical design and electrical to locate motors, and instruments, to improve routing to obtain shortest distances."	45%

(2) At the hearing, the Division explained that it considered electrical design engineering, F.1.A through F.5.A, as taxable because petitioner was just developing sets of drawings or blueprints as an end product. Prior to the hearing, the Division stated that it considered F.1.A. through F.5.A. taxable for the same reason it considered E.1 through E.6 taxable.

(3) In these activities, the engineer is using the CADE system to develop the design. When one looks at the activity, such as routing of conduit, examining cable tray design and aboveground power and control design, the engineer who is involved in these activities is using the CADE system to try various combinations of routing and materials. Through trial and error, the engineer is using the system to provide the analysis of what is deemed to be an improved configuration of the layout.

(4) It is petitioner's position that items F.1.A through F.5.A are exempt from tax under 20 NYCRR 528.11(b)(1) because they are used to develop new products and/or improve

existing products. Petitioner uses the CADE system to produce a product which meets its high standards.

(f)(1) Under the title of Cold Box Engineering, petitioner listed the following items which it considered exempt from tax:

<u>"Item</u>	<u>Description</u>	<u>Dept. % Use</u>
H.1.A,B,C Conceptual Cold Box Configuration	Conceptual Cold Box Configuration. For each new cold box design, a 2-D conceptual configuration is required. To develop this configuration, equipment shapes and schematic piping drawings are made. It is the Engineer's responsibility to optimize the cold box layout while maintaining the functional requirements of the process. The procedure involves manipulating the layout to achieve the cost-effective assembly recognizing shipping, manufacturing, and process constraints.	1%
H.2.A Model 3-D Equipment Shapes	In preparation of developing the detailed layout of a cold box, equipment shapes are modelled 3-D and located in the cold box. Once located, configuration optimization of vessels (storage tanks, separators) within the constraints listed in H.1.A, B, C, takes place.	2%
H.2.B,C Develop 3-D Piping Routing and Perform Pipe Flexibility Analysis	The major engineering and design effort in developing the detailed layout of a cold box is the 3-D pipe routing and associated flexibility analysis of all process piping. The Designer's responsibility is to route the piping optimally while avoiding potential interferences. Using the CADE system, a trial and error	36%

procedure is used until a satisfactory routing is established.

Once a routing is determined, the Engineer performs his flexibility analysis. Nearly 100% of the pipes will require rerouting due to either too much (meaning the routing can be further optimized) or too little flexibility exists. The Designer will then reconfigure the piping to accommodate the analysis. This trial and error procedure (tempered with engineering judgment) is repeated until an optimized routing is obtained.

Incorporated into this analysis is the determination of pipe support locations. Pipe supports put further constraints on flexibility analysis. The Engineer selects support locations and inputs these constraints into the flexibility analysis. Through the analysis, further trial and error is required to optimally locate the supports while still maintaining a flexible system.

#### H.2.D,E

Model Major Equipment Supports and Perform Interference Checking

Major equipment supports are modelled 3-D in the cold box assembly. The space limitations are dictated by the configuration of piping and equipment. Optimization of the physical support member size versus the allocated space is determined by performing the interference checking routine on the CADE system. This routine allows the Designer (through trial and error) to input various support member sizes to determine a configuration that maintains proper clearances.

7%

H.2.F Pressure Drop Analysis	Once the piping system is completed, including interference checking and flexibility analysis, the CADE system is used to determine process piping pressure drops based upon the pipe configuration. Further optimization of the piping system may be required to meet the process requirements.	3%
H.3 Fabrication Details for Cold Box	Once the piping assembly configuration is complete, fabrication details are developed. These details are CADE developed and are generated to complete the final cold box assembly.	
H.3.A Final Pipe Assembly Design	The final pipe assembly details include the labelling, dimensioning, locating pipe supports, etc., to make the assembly drawing complete.	12%
H.3.B Final Casing and Equipment Support Design	The final casing and equipment support details are generated.	3%
H.3.C Instrument Lines	Small instrument lines are routed. The routing is schematically done on the CADE system."	3%

(2) At the hearing, the Division explained that it disallowed the items pertaining to cold box engineering because it considered these activities site work. Except for item H.3.A., the Division stated, prior to the hearing, that it considered the foregoing activities as design engineering and not research and development. With respect to item H.3.A., the Division stated that "preparation of final drawings of design engineering is not R & D."

(3) The items in issue pertaining to cold box engineering involve taking into account the expansion and contraction of material as temperatures progress from cryogenic to elevated levels. Using the CADE system, petitioner devises the optimum routing of the piping.

Cold box engineering is the most critical part of the air separation units because it is where the separation of air occurs.

(4) Petitioner maintains that items H.1.A. through H.3.C. are exempt from tax under 20 NYCRR 528.11(b)(1) because they are used to develop new products and/or improve existing products.

The activities being focused upon allowed petitioner to improve the design to either provide a greater competitive advantage or to improve petitioner's ability to satisfy customers' expectations. The CADE system allows petitioner to determine optimum designs.

On the basis of its analysis, petitioner determined that it used the CADE system in research and development 64.6% of the time. It obtained this percentage by adding the percentages obtained by multiplying the percentage use of each application by the percentage of the total CADE system that each department uses.

### ***OPINION***

Tax Law § 1115(a)(10) exempts "[t]angible personal property purchased for use or consumption directly and predominantly in research and development in the experimental or laboratory sense." The meaning of the term "research and development", as set forth in Tax Law § 1115(a)(10), is defined in the Commissioner's regulations as follows:

"(b) Research and development. (1) Research and development, in the experimental or laboratory sense, means research which has as its ultimate goal:

"(i) basic research in a scientific or technical field of endeavor;

"(ii) advancing the technology in a scientific or technical field of endeavor;

"(iii) the development of new products;

"(iv) the improvement of existing products; and

"(v) the development of new uses for existing products"  
(20 NYCRR 528.11[b]).

"Direct use in research and development" means actual use in the research and development operation as opposed to collateral use (20 NYCRR 528.11[c][1]). Tangible personal property is used "predominantly" in research and development if over 50 percent of the time it is used directly in such function (20 NYCRR 528.11[c][2]). Tangible personal property is exempt only if it meets the tests of direct and predominant use (20 NYCRR 528.11[c][3]).

The Administrative Law Judge rejected the Division's assertion that it is useful to refer to provisions of the Internal Revenue Code and pronouncements of the Financial Accounting Standards Board for guidance in determining whether petitioner's activities constitute research and development in the experimental or laboratory sense.

The Administrative Law Judge found that:

"[o]n the basis of Matter of Modern Refractories Serv. Corp. (Tax Appeals Tribunal, December 15, 1988, affd 164 AD2d 69, 563 NYS2d 200) it is concluded that prevailing New York Authority is sufficient to resolve the issues presented and, further, that the activities in issue do not constitute research and development in the experimental or laboratory sense" (Determination, conclusion of law "C").<sup>3</sup>

Relying on Modern Refractories, the Administrative Law Judge determined that:

"all of the activities in issue [in this case] were conducted by petitioner's engineering division as part of its commercial operation of designing gas separation plants. Under these circumstances, further research and development in a commercially operational use cannot be considered 'in the experimental or laboratory sense' [cite omitted]. Furthermore, as in Matter of Modern Refractories Serv. Corp. v. Dugan (164 AD2d 69, 563 NYS2d 200), petitioner has not explained why research and development of the air separation plant could not be conducted in other than commercial operations for a customer such as in its research and development department. Therefore, the activities involved herein are collateral and not used directly in research and development as required by 20 NYCRR 528.11(c) (Matter of Modern Refractories Serv. Corp. v. Dugan, supra, 563 NYS2d 200, 201)" (Determination, conclusion of law "E").

---

3

In Modern Refractories, the taxpayer, at the request of its customers, developed a Hot Suit which allowed the taxpayer's employees to service its customers' furnaces or ovens while they were still hot and without interruption in production. The development of the Hot Suit was done over a period of time while the taxpayer performed its service function for its customers. We concluded that development in this manner did not fit the "experimental or laboratory sense" of the statute and regulations.

The Administrative Law Judge found that "the Advisory Opinion which was issued to petitioner was vague and not directed to any of the specific items listed in this determination" (Determination, conclusion of law "F").

On exception, petitioner argues that Modern Refractories is irrelevant and inapposite to this case. Petitioner distinguishes this case from Modern Refractories stating that:

"[u]nlike Modern Refractories, where the petitioner developed the hot suit system during its normal commercial cleaning operations, Petitioner is developing a new and unique product from scratch each and every time it designs a new air separation plant. Petitioner clearly does not have one plant design which it modifies each time it builds a new plant" (Petitioner's brief, p. 8).

Petitioner asserts that it:

"cannot conduct research and development activities relating to air separation plants in other than commercial operations such as in its research and development department. As noted, each gas plant is unique based on many factors that enter into its design - customer requirements, topography, climate, utility hookup, etc. Thus, a gas plant cannot be designed in a vacuum without all these limiting factors present. It can only be done with the limiting parameters of the particular customer. Petitioner assigns a project to its engineering department where it is customer specific. Projects which are not customer specific are assigned to its research and development department. By default a custom-designed gas plant must be assigned to its engineering department" (Petitioner's exception, Attachment 1).

Petitioner asserts that it uses the CADE system in the experimental or laboratory sense. Specifically:

"Petitioner is using the CADE system on a trial-and-error basis to design a unique, one-of-a-kind air separation plant to meet its customer's needs and satisfy all of its parameters. The utilization of the CADE system has as its ultimate goal the development of a new product - a unique plant - or, at the very least, the improvement of an existing product. Both qualify as research and development within the meaning of those terms under [the Division's regulations]. Furthermore, Petitioner is advancing the technology in the field of gas plant design each time its [sic] designs a new plant. This also qualifies as research and development under [the Division's regulations]" (Petitioner's brief, p. 7).

Petitioner asserts that the advisory opinions issued by the Division (i.e., Petition of Sybron Corporation, TSB-A85[17]S; Petition of Houdaille Industries, Inc., TSB-A85[13]S;

Petition of Peerless-Winsmith, Inc., TSB-A-92[10]S; and Petition of Union Carbide Corporation, TSB-A-88[10]S) are relevant to the issues at hand and are sufficient authority to conclude that its activities do constitute research and development in the experimental or laboratory sense. Petitioner points out that each of the advisory opinions addressed the use of a computer assisted design system (CAD/CAM computer) to develop and design "custom built machinery" (Sybron), "develop new products and improve existing parts" (Houdaille); "develop new products, design and develop a product solely for one customer, redesign a product to fit a customer's application where its redesign required calculations to insure proper alignment and operation" (Peerless-Winsmith).

Petitioner asserts that, based on the documentary evidence and the testimony of its witnesses, "its use of the CADE system in qualifying research and development activities amounted to more than 50%, and in fact 64.6%, of the total time that the system was used" (Petitioner's brief, p. 9). Petitioner asserts that the Division did not contest the methodology used by petitioner in computing these percentages.

Petitioner asserts that its witnesses were highly qualified engineering experts with extensive experience in using the CADE system. In comparison, the Division's auditors are accountants with no experience or training in auditing a company involved in engineering and research. Moreover, asserts petitioner, the Division's witness "was unable to testify as to the technical background and expertise of the author of the Law Bureau's opinion introduced as Exhibit I at the hearing. He could only state that he was an attorney. He was also under the impression that whoever drafted the letter never physically visited petitioner's Tonowanda site to view the equipment" (Petitioner's brief on exception, p. 14). For these reasons, petitioner asserts that the testimony of the Division's witnesses should be given little weight.

In response, the Division asserts that the activities performed by petitioner are not qualifying research and development activities. The Division asserts, in essence, that the CADE system is used to optimize plant layout and design and that this activity is not basic

research but strictly an engineering activity which takes basic research done elsewhere and applies it and other existing knowledge to a specific set of facts. The Division's brief on exception, as did its posthearing brief, supports its position by asserting that:

"[i]t is helpful to look to federal law for guidance in the absence of New York case law addressing the meaning of 'research and development in the experimental or laboratory sense.' The Internal Revenue Code of 1986, as amended, ('IRC') contains two research and development incentive provisions: Section 174, which allows a deduction; and Section 41, which allows a nonrefundable credit" (Division's brief on exception, p. 5).

We affirm the determination of the Administrative Law Judge.

The burden on petitioner is to show that the CADE system is used "directly" (as opposed to being used collaterally in petitioner's commercial enterprise of designing industrial gas plants) and "predominantly" (over 50% of the time) in research and development in the "experimental or laboratory sense."

Petitioner has not met its burden.

We deal first with the issue of "direct" use. The CADE system is an integral aspect of petitioner's commercial business, i.e., designing gas plants. In order to satisfy its burden of proof, petitioner under these circumstances must identify at what times research occurred independent of the design activity (Matter of Modern Refractories Serv. Corp., supra). Petitioner offers no argument on this specific point and, thus, has not established that research and development occurred separately from its commercial operations.

However, we note that in affirming our decision in Modern Refractories, the Court implied that an adequate explanation of why a taxpayer could not conduct research and development activities under conditions other than commercial operations might be sufficient to overcome the exclusionary effect of the Division's regulation. Petitioner offers such an explanation here asserting that it:

"cannot conduct research and development activities relating to air separation plants in other than commercial operations such as in its research and development department. As noted, each gas plant is unique based on many factors that enter into its design - customer requirements, topography, climate, utility hookup, etc. Thus, a gas plant cannot be designed in a

vacuum without all these limiting factors present. It can only be done with the limiting parameters of the particular customer. Petitioner assigns a project to its engineering department where it is customer specific. Projects which are not customer specific are assigned to its research and development department. By default a custom-designed gas plant must be assigned to its engineering department" (Petitioner's exception, Attachment 1).

In essence, the argument is that where a plant is to be built, it is assigned to the engineering department; where there is no plant to be built, the "projects" (presumably concerning aspects of plant development) are assigned to the research and development department. In short, the assertion merely reflects how petitioner conducts its business operations, i.e., petitioner allows its engineering department to design plants to be built and its research department to do research. We fail to see how this assertion shows that research and development cannot be done in other than commercial operations. Moreover, the practical extension of petitioner's argument is that all custom design work would meet the "direct" use test of the statute. Surely, this is beyond the pale of the Court's statement.

Since petitioner has not shown that the CADE was used separate and apart from its commercial activities, i.e., solely for research and development, we conclude that it was not used "predominantly," i.e., over 50% of the time, in research and development.

We deal next with whether the CADE system was used in the "experimental or laboratory sense."

Petitioner argues that Modern Refractories is not relevant because in that case the taxpayer "developed the hot suit system during its normal commercial cleaning operations [while petitioner] is developing a new and unique product from scratch each and every time it designs a new air separation plant" (Petitioner's brief, p. 8).

We do not agree. The common thread between the two cases is the fact that both taxpayers conducted their asserted research and development activities in conjunction with their commercial business activities.

In Modern Refractories, the facts showed that the research of the hot suit occurred during the same period of time as the taxpayer was performing its commercial cleaning services. Here, the asserted research and development activities of the CADE system are conducted in conjunction with petitioner's business, i.e., the design of industrial gas plants and selling of atmospheric gases to various customers. In Modern Refractories, we noted that "only research in the 'experimental or laboratory sense' is exempted." While section 1115(a)(10) does not expressly state that research and development in the experimental or laboratory sense cannot occur simultaneously with production or the furnishing of paid services, the statutory definition of research and development excludes some activities more akin to research and development than outright performance of paid services, such as the ordinary testing or inspection of materials or products for quality control. "We would turn the statute's plain meaning on its head to hold that [Modern's] 'hot suit research,' when done concomitantly with its cleaning service, could possibly be performed 'in the experimental or laboratory sense'" (Matter of Modern Refractories Serv. Corp., *supra*).

We concluded that such commercial use was outside the scope of the research and development exemption and, without a more clear-cut delineation of the earlier stages of evolution of the hot suit, Modern Refractories failed to sustain its burden of establishing entitlement to the exemption. The Appellate Division affirmed our conclusion.<sup>4</sup>

---

<sup>4</sup>In its November 1, 1990 decision, the Appellate Division stated:

"The Tribunal could reasonably conclude, consistent with the language of both the statute and regulations, that once a product's development reaches the stage of being capable of operational use and is actually so used in commercial operations, the research and development exemption for product purchases related to such operations no longer applies. At the least, any further research and development in such commercially operational use can hardly be deemed to be performed 'in the experimental or laboratory sense' (Tax Law § 1115[a][10]). Moreover, the regulations . . . provide that [the] 'usage in activities collateral to the actual research and development process is not deemed to be used directly in research and development' . . . . Petitioner has not explained here why research and development of the hot suit system could not have been satisfactorily conducted under conditions other than in commercial operations for a customer. Therefore, it was rational for the Tribunal to consider usage in such activities as

We reach the same result here. It is clear that the CADE system is inextricably linked with petitioner's commercial activities of designing plants. Following the same reasoning we applied in Modern Refractories, such commercial activity is inconsistent with the plain meaning of the phrase "experimental or laboratory sense" as used in the statute.

Finally, we point out that our conclusion here is consistent with the overall thrust of the Advisory Opinion rendered to petitioner. In brief, while the Advisory Opinion states the general principle that the CADE system is exempt from sales tax to the extent used to perform research and experimentation to develop better and more efficient production equipment, it conditions that statement on the CADE system meeting the statutory and regulatory standards applicable to the exemption, i.e., used directly and predominantly in the experimental or laboratory sense. In this regard, we note that the Opinion clearly states that the use of the CADE system "for ordinary design and drafting functions does not qualify as research and development in the experimental or laboratory sense . . . [and that] the use of the [system] to establish facility configurations or to modify facilities to conform to the topography of the customer's land site does not qualify as research and development in the experimental or laboratory sense." Finally, the opinion makes it clear that "usage in activities collateral to research and development (e.g. administrative and management functions) does not qualify as research and development" (TSB-A-88[10]S).

Accordingly, it is ORDERED, ADJUDGED and DECREED that:

1. The exception of Union Carbide Corporation is denied;
2. The determination of the Administrative Law Judge is affirmed; and

---

collaterally and not directly involved in research and development. . . .

"Without necessarily deciding that under no circumstances could purchases for research and development in conjunction with a functional product in actual commercial operation qualify for the exemption [cite omitted], we conclude that here the Tribunal's denial of the exemption was rational" (Matter of Modern Refractories Serv. Corp. v. Dugan, supra, 563 NYS2d 200, 201-202).

3. The petition of Union Carbide Corporation is denied.

DATED: Troy, New York  
April 13, 1995

/s/John P. Dugan  
John P. Dugan  
President

/s/Francis R. Koenig  
Francis R. Koenig  
Commissioner